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A BRIEF SURVEY OF SHEEP DISEASES IN NEW ZEALAND.*

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NEW ZEALAND is fortunate to be without such serious scourges of sheep as scab, sheep-pox, and anthrax, and on that account the country can export its wool and meat to the world's best markets with comparative freedom. Certain diseases do occur, however, and for the purpose of these notes they will be dealt with according to the age of the animal, beginning with lambs, then taking hoggets and adult sheep.

Two major troubles are to be found in lambs born from healthy parents—so-called pulpy kidney, and arthritis. Lambs born dead or weakly, and those born deformed or with goitre, &c., will be disregarded here.

PULPY KIDNEY.

This is a widespread trouble among lambs, chiefly on first-class country. A very considerable amount of time, thought, and laboratory and field work has been given to this subject for a number of years in New Zealand. The losses amount in the South Island to somewhere about 4 per cent. in districts such as Central and Northern Otago, Southland, and Canterbury; in the North Island the disease is seen in more isolated instances. The best and biggest lambs are those affected. They may be found dead, or they may be only "dopey," with heads in fences, or they may be violent circlers or brain cases. Appearance some time after death in acute cases shows a pulpy condition of the kidney, but this is entirely a *post-mortem* change. It has, however, led to the erroneous name "pulpy kidney." The condition is associated, it is believed, with the richer milk of some ewes, the increased fat in it by some means allowing the lamb to absorb poisons from the bowel, thus causing death or some bodily injury.

That the condition is primarily a dietetic one is shown by the fact that in lean seasons the trouble is at a minimum, while in rich flushes the death-rate increases markedly. Use is made of

* Substance of a radio broadcast lecturette.

this fact to control the mortality, the most useful means being that of yarding ewes and lambs at the first appearance of trouble. The yarding is practised in the paddock by making a temporary yard of netting into which the ewes are driven early in the morning on one day, and not allowed out till the same time on the following morning. This is repeated about every five days until the lambs are four to six weeks old, when the mortality usually stops. There may be a recurrence at weaning-time, but sudden weaning usually puts a stop to further deaths.

Arthritis.

Arthritis or inflammation of the joints of lambs usually occurs following castration and tailing operations. Where it occurs before, it is usual to find that lambs have been infected by way of the navel and frequently have spotted livers as well as the lameness. At docking attention is not always paid to the fact that lambs are very easily infected with pus-producing and other germs, and that these organisms invariably make for some one or more of the joints of the lamb. Inflammation is set up, the joint swells and is extremely painful, and the lamb is unable to feed about and so loses condition.

Most of the affected lambs are lame only temporarily at about the third to the tenth day, but others retain the inflammation, which becomes chronic and ends in large joints, leading to condemnation at the meat-freezing works. The condition of large joints is usually due to one specific organism, which is so similar to the causative germs of a disease in pigs known as erysipelas that no difference can be seen. Yet there is no swine erysipelas in New Zealand as far as we know. The germ has still to be inoculated into pigs experimentally to see whether it will infect them. The arthritis set up in lambs by this organism causes a fairly large loss at the meat-export works, and more care should be taken to curb the disease by establishing better methods of castration and docking. Arthritis can be prevented with care. One must not compare lameness from arthritis with the lameness from muscular hæmorrhage seen in lambs overnourished and on the borderline of pulpy kidney.

Parasitic Gastritis among Hoggets.

If a hogget were allowed to have its choice it would be feeding in places right away from first-year grass or a soft autumn flush of pasture, and would be where the feed was drier and harder but of a sweet nutritious nature. Native-grass hillsides are much better pastures for hoggets than the rich soft flats. Watery feed causes loss in condition at once, and when a hogget once commences to decline various parasites gain the upper hand, and a month from that time may see the death of their poor host from starvation and anæmia. It can be understood then that the farmer who *will* put his hoggets on the young grass or on to the richest of flats, unless the weather is kind and a dry spell protects, is looking for mortality from so-called parasitic gastro-enteritis.

The position is difficult for owners of rich flats, but it would be wiser to first run older sheep over such pasture and thus feed off

the top grass before putting in the younger sheep, recognizing that there is some chance of escaping a parasitic invasion by that means, but no chance if the lambs are given the first picking. If feed conditions are good one should need no worm drenches to keep the hoggets in good order; if the conditions are only fairly good, then drenches at three to four weeks' intervals may tend to keep parasites in check; but if feed conditions are incorrect, then no drenching with parasiticides will save the hoggets. If conditions are expected to be bad—that is, if a flush of grass is expected, or if young grass only is available for the hoggets—then hay or ensilage should be provided, and if necessary an early start made with feeding chaff and crushed oats as well.

In a summer and autumn of extensive rainfall the lambs off the mothers are liable to be second grade at the meat-works in December and January, and they do not improve. In moderately dry seasons the lambs are normally first grade and maintain their weight until the wet autumn flush comes along, when the hoggets, as they then are, will be too often noticeably on the downward road. It is thus advisable to attend to paddock conditions rather than rely only on medicaments for the control of parasitic gastritis and the heavy mortality which results therefrom.

Ante-partum Paralysis.

Diseases of adult sheep may reasonably be divided into those associated with pregnancy, such as ante-partum paralysis, lambing sickness, and bearing troubles, and those due to other causes, whether specific or dietetic, and classified as "general."

Ante-partum paralysis is one of the most serious troubles in the country, coming as it does just before lambing, among the best ewes on the best pasture, and under what might be considered ideal conditions by those who do not realize the ease with which sheep are upset when they are bearing twin lambs and when pasture conditions are not exactly right for them. Both ewes and lambs die, and the trouble is likely to continue among large numbers of the ewes unless energetic measures are taken to stop it.

A series of examinations at Wallaceville of the blood of affected animals has shown that there is an accumulation in the blood of a substance usually excreted with the bile from the liver and called cholesterol. From the fact that sheep are always on the down grade in ante-partum paralysis, fat is being quickly thrown into the blood-stream from fat depots in the body and sent to the liver, where it cannot be dealt with fast enough. If the ewe can live until the lambs are born, then this cholesterol is also excreted in the milk and the ewe quickly regains her balance. (One cannot say definitely that cholesterol is the cause of the mortality, however.) The lamb's blood after a week of milk-feeding shows an excess of cholesterol, but at three weeks the blood is again normal. In the analyses at Wallaceville blood-sugar varied considerably, and it was considered to be no very great factor in the trouble. Sugar treatment in the hands of the departmental officers was a failure.

Ante-partum paralysis is primarily a dietetic disease, and is associated with the balance of fat in the body. Fat sheep must be

kept fat and not allowed to sink in condition if this trouble is to be avoided, more particularly in the last six to eight weeks of pregnancy. It may require the conservation of more hay or ensilage, but this should be realized by the farmer and provided if his paddocks are not sufficient to keep up the condition of the sheep. Pregnant animals require to rise slowly in condition from tupping to lambing, rather than to fall.

When once the full force of the mortality is experienced then curative measures may be undertaken, and it is believed that flushing on young crop or luscious grass will overcome the mortality. This has been the case in the past season, and the change in a flock from listlessness to full vigour was very marked where flushing was practised. Whether that would be the case in a season in which the grass was too luscious and innutritious, rather than dry and short, remains to be seen. Mineral deficiencies are not considered to be a factor in ante-partum paralysis so far as our present knowledge goes.

Lambing Sickness.

In appearance lambing sickness is very similar to ante-partum paralysis, but the symptoms are much more severe. In this trouble there is a definite lime deficiency in the blood, and the condition is actually one of milk-fever in ewes. It occurs seasonally in heavy-milking ewes on rich pasture where there is any suggestion of deficiency of lime. Treatment with chloride of lime solution into the veins is very effective, and is spectacular in its results. Prevention lies in top-dressing the pasture with lime, or, where troughs are used to water the sheep, the keeping of lime in such troughs. A few handfuls every fortnight (as is practised at Ruakura State Farm) are a wonderful help in combating milk-fever, parasites, &c.

Eversion of the Vagina.

Bearing trouble of ewes is one which often causes loss. It is not yet thoroughly understood, but is dietetic in origin and probably has two causes, one being laziness in the matter of urination, resulting from the fat condition of the animal, and the other to the large bulk of food which sheep take in on fibrous or soft pastures, so decreasing the room required by the ewe when carrying twin lambs. In order to prevent this condition, ewes heavy in lamb require nutritious food of little bulk, and also require regular exercise, more particularly in the early hours of the morning.

Where eversion of the vagina has actually occurred treatment is urgent, and this will differ according to circumstances. By up-ending the sheep with its hind legs in the air the vagina can be smeared with a carbolized oil and easily returned. If possible the bladder should be emptied when the ewe is on the ground. Single-handed, it is sometimes too difficult to operate with the ewe up-ended, and similar measures are performed with the animal prone on the ground. The ewes are then put in a bare paddock or in the woolshed, with water but with little food, until they lamb. Frequently a stitch, a strap, or, in long-woolled sheep, a strand of wool tied across is necessary to hold the vagina in; but every farmer has his own method and understands the need for watching the ewe for lambing.

Caseous Lymph-adenitis.

Under general diseases caseous lymph-adenitis may be referred to first because of its economic relation to the meat-export trade. Its occurrence in the South Island has been known for many years, but the purchase of South Island sheep has set up centres of infection in some parts of the North Island. So much has been said concerning this disease recently that all sheep-farmers will know how to look for abscesses in the front of the shoulder, the flap in front of the hind leg where the leg joins the belly wall, and in the crutch—in ewes at the base of the udder, and in wethers alongside the purse.

To deal with the condition farmers should at any convenient time go through all their sheep, particularly in the three months following shearing and just before shearing in full wool, at the sites mentioned, for abscess formation. This can be done quickly and easily in crush pens, two men working side by side from behind the sheep and letting them run back as the palpation finishes. There is no need to up-end the sheep. Where abscesses are open, or where they can be felt at all, the sheep should be raddled and later culled out for dog-food, or even for house purposes, provided the gland affected is taken out. Affected sheep should not be left among the flock. Sheep may become infected at shearing-time from contaminated shears and from open abscesses. Lambs may get infected at docking, but unshorn lambs are remarkably free from this disease, which is more frequently found among the older animals.

Care in disinfecting shearing-machines is the second requisite. Machine heads can be detached and cleaned in hot water and soap, and then put into a disinfectant solution, preferably hot. Clean disinfected heads can be hung up on the board. This method requires a spare head, or two spares with a team of six shearers.

Fortunately, most of the farms affected with lymph-adenitis in New Zealand have a very light infection, and care will completely eliminate this disease.

Black-disease.

This disease, which at one time caused considerable mortality in part of Hawke's Bay, is now being successfully stamped out by attention to eradication of the liver-fluke parasite. The germ causing death gained entrance to the area in the liver damaged by the young liver-fluke, and when established in such centres formed a very potent poison which killed the sheep in a few hours. By attention to drainage of swamps, killing the intermediate host of the parasite (a fresh-water snail), and drenching the sheep with carbon tetrachloride to kill the fluke, Hawke's Bay is now remarkably free from this form of mortality; one farmer who lost two thousand sheep in five years, now loses none.

Malignant Oedema.

Malignant oedema is rarely seen now, but at one time was responsible for large numbers of deaths in lambs and sheep at docking and shearing-time. The germ gained entrance into wounds from dirty yards and sheds, and killed the sheep in twelve to thirty-six

hours. The attention to cleanliness of sheds and yards and the burial of carcasses have been of very material aid in stopping this deadly complaint. It is still occasionally seen, however, where old burial-grounds are ploughed up and turnips sown. Mortality in hoggets grazing on such areas sometimes occurs.

Pink-eye.

Pink-eye is regularly seen among sheep in some districts. It is a contagious disease causing blindness from inflammation of the eyes. The tears are very contagious, but the actual organism concerned, although diligently looked for, has not yet been found. This form of ophthalmia quickly passes on to all sheep in the flock, but leaves them within a fortnight without any ill effects, and, it is thought, immune to further attacks. The affected flock requires to be kept in flat paddocks free from logs and drains, and dogs must be kept strictly away. The after-effects are only dangerous if the sheep injures the eyeball during its period of blindness. The dust on affected farms or roads carries infection from season to season.

Foot-rot.

This is perhaps one of the most difficult troubles to overcome on flat farms. Any germ seems to be able to set up the condition once the foot has been reduced to a state in which the organism can act. The chief predisposing factor is thought to be scald between the toes in damp weather. Mud, especially mud in which foot-rot cases have moved previously, is the other. Once foot-rot has appeared on a farm the gateways, yards, and small paddocks and waterways become disseminators of infection, provided the foot is in a state to receive that infection. Many countries describe definite causative organisms in these foot-rot cases, but we in New Zealand have as yet not found any one germ predominant.

Where foot-rot is present foot-baths are a necessity, and it is difficult to find a better treatment than paring of the feet and a copper-sulphate solution for the general flock at regular intervals, which must be as frequent as possible. More drastic action is required where the cases are bad, until culling can be arranged at some profit. Formalin, butter of antimony, &c., can be used in the very bad cases as single dressings after the paring. More work is required on this disease, and this is being arranged for at the Wallaceville Laboratory.

Circling.

Circling is a condition seen on some farms, where sheep commence turning in circles and finally die. Where the condition is not due to cysts in the brain nor to nasal bot, it is attributed to an infection of the blood-stream, with lodgment of organisms in the brain and spinal cord, causing damage resulting in the circling movement. This trouble is at present a matter of investigation, and nothing further can be stated with certainty.

Mineral Deficiency.

There are several areas in New Zealand where deficiencies of minerals cause trouble in sheep, and other areas where it is suspected that the lack of certain minerals accounts for the inability of sheep to thrive.

Iodine deficiency in certain South Island inland localities results in lambs being born with enlarged thyroids, a condition of goitre. Many such lambs are born without wool and before time, with the result that the lamb mortality is high. Generally speaking, except for the small known areas, there is not a deficiency of iodine in New Zealand sufficient to cause trouble in adult sheep.

Iron deficiency occurs in the pumice belts round Rotorua, Mamaku, and Taupo. Anæmia and death result if the sheep are not changed off this country. Consolidation of the top layer of soil by cultivation does much to alleviate the condition, and, where feasible, iron licks and pellets have been tried with promising results.

Lime and phosphate deficiency or defect in the balance of these minerals is also known, but incompletely. The Mairoa district is one in which this type of trouble is known, and experimental work has been conducted, the land being dressed with a mixture of lime (five parts) and superphosphate (two parts). On the Moutere Hills, Nelson Province, there is also a serious shortage of lime and/or phosphate, which is corrected by providing special licks.

Conclusion.

In conclusion, it may be mentioned that the Department of Agriculture is always interested in sheep troubles, and it is to the benefit of farmers to give every assistance by affording to officers of the Department information on the questions arising. For example, at the present time a new condition has been noted in Auckland Province, a condition of jaundice and redwater. The cause is as yet entirely unknown where it occurs in Australia, South Africa, the United States, and the Continent of Europe. Investigation of such troubles on the spot and from all scientific aspects would often give New Zealand an opportunity to lead the way. Analyses of animal specimens, soils, and pastures; examination of pastures for weeds deleterious to stock, *post-mortem* examination of sheep in the field, laboratory work on blood and urine, sections of organs for microscopical examination, and, finally, experimental inoculation of animals for results, form the method of approach in considering the cause and effect of sheep diseases.

Comparative Feeding-values.—Hay, silage, and mangels are all characterized by much variation in their respective feeding-values, and thus any exact statement of the comparative value of the three feeds is not feasible. Chemical analysis as a means of ascertaining the relative feeding-values is quite insufficient, because of the operation of such factors as palatability, which are not indicated by analysis. As a result of live-stock feeding trials, Amos, of Cambridge, states that 1 lb. of 25-per-cent. silage equals 2 lb. of roots, and 1 lb. of hay equals 3 lb. of silage. Results obtained by Rae, in Hertfordshire, Sheehy at Athenry, and Drew at Glasnevin, in a general way confirm the figures given by Amos. Advice has been received from many reliable sources that stock thrive exceptionally well on silage. So persistently has this been reported that one is forced to the conclusion that silage has some specially valuable feeding quality or qualities the nature of which is not yet fully understood.—*Fields Division.*

MINERAL CONTENT OF PASTURES RESEARCH.

THE WAIRARAPA DISTRICT.

Abstract of Paper by B. C. ASTON and others, in the *New Zealand Journal of Science and Technology*, April, 1931.

THE paper here summarized contains detailed results of the analyses of pasture samples collected over a period of years from several distinct types of soil in the Wairarapa district.

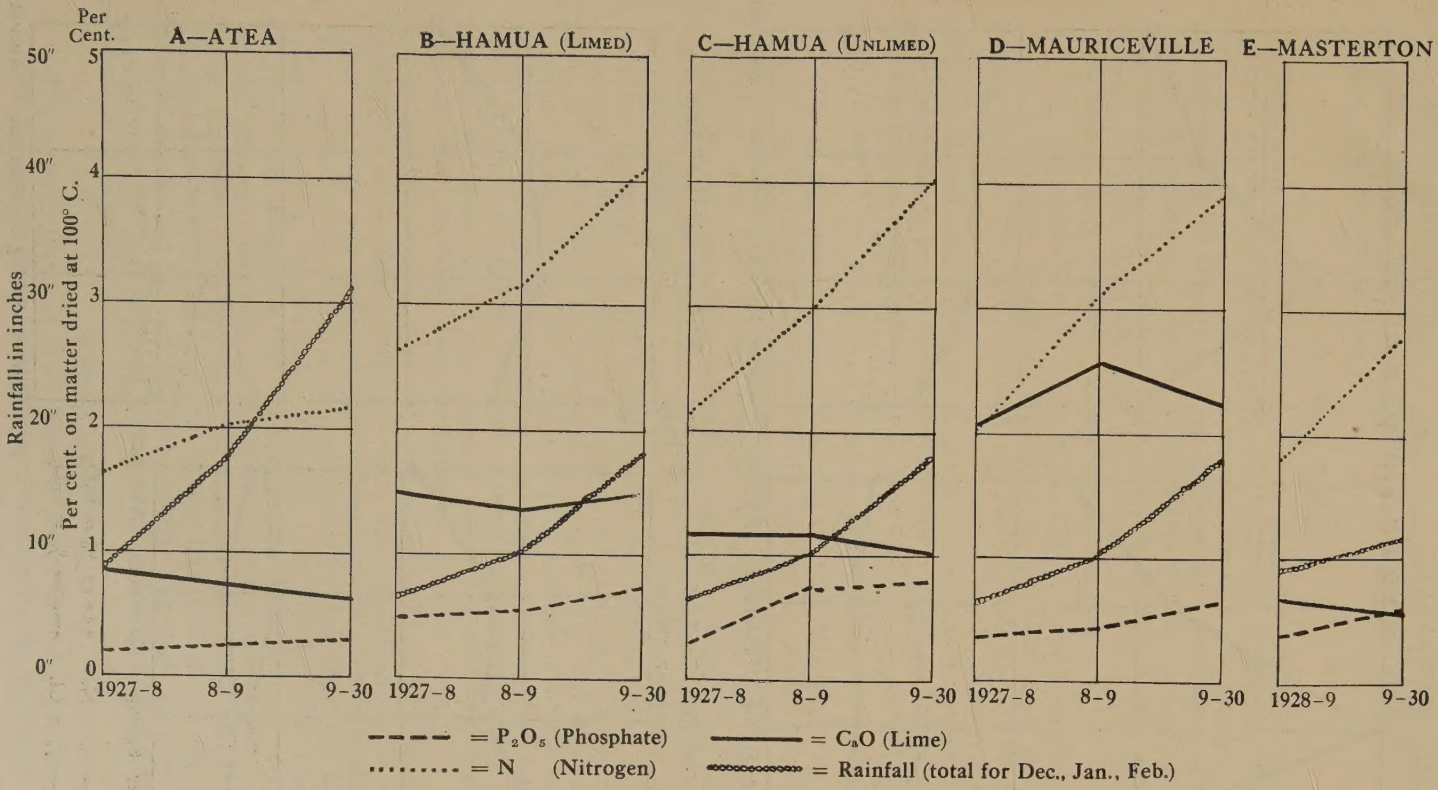
Since 1928, when a preliminary article appeared in the *N.Z. Journal of Agriculture* for October, 1928, and later ones in August, 1929 and 1930, the work of investigating the soils and pastures has been steadily advanced in field and laboratory. Seasonal changes of composition in the pasture have been examined by the collection of samples by the same officer at different times of the year from the same paddocks in representative types of country.

SOIL RESULTS.

A summary of the results obtained shows that the soil analyses reveal no soil of excessively coarse nature, such as the pumice sandy silts or even the coastal dune sands; so that from a mechanical point of view—and this is the most important aspect under New Zealand conditions—the soils show no inherent structural defect. The finest-textured soils are silt clays, and the coarsest are fine sandy loams. There are, however, certain areas in which a decided malnutrition disease develops in stock (mostly in dairy cattle) in which the deficiency is phosphoric acid, since the symptoms are those of "Waihi disease," a bone malnutrition trouble manifested by lameness and swollen joints, and curable by dosing the subjects with phosphates in the form of lick or medicinal drench, or by top-dressing the pastures with phosphates. The bones are the repository or storehouse of phosphates within the animal.

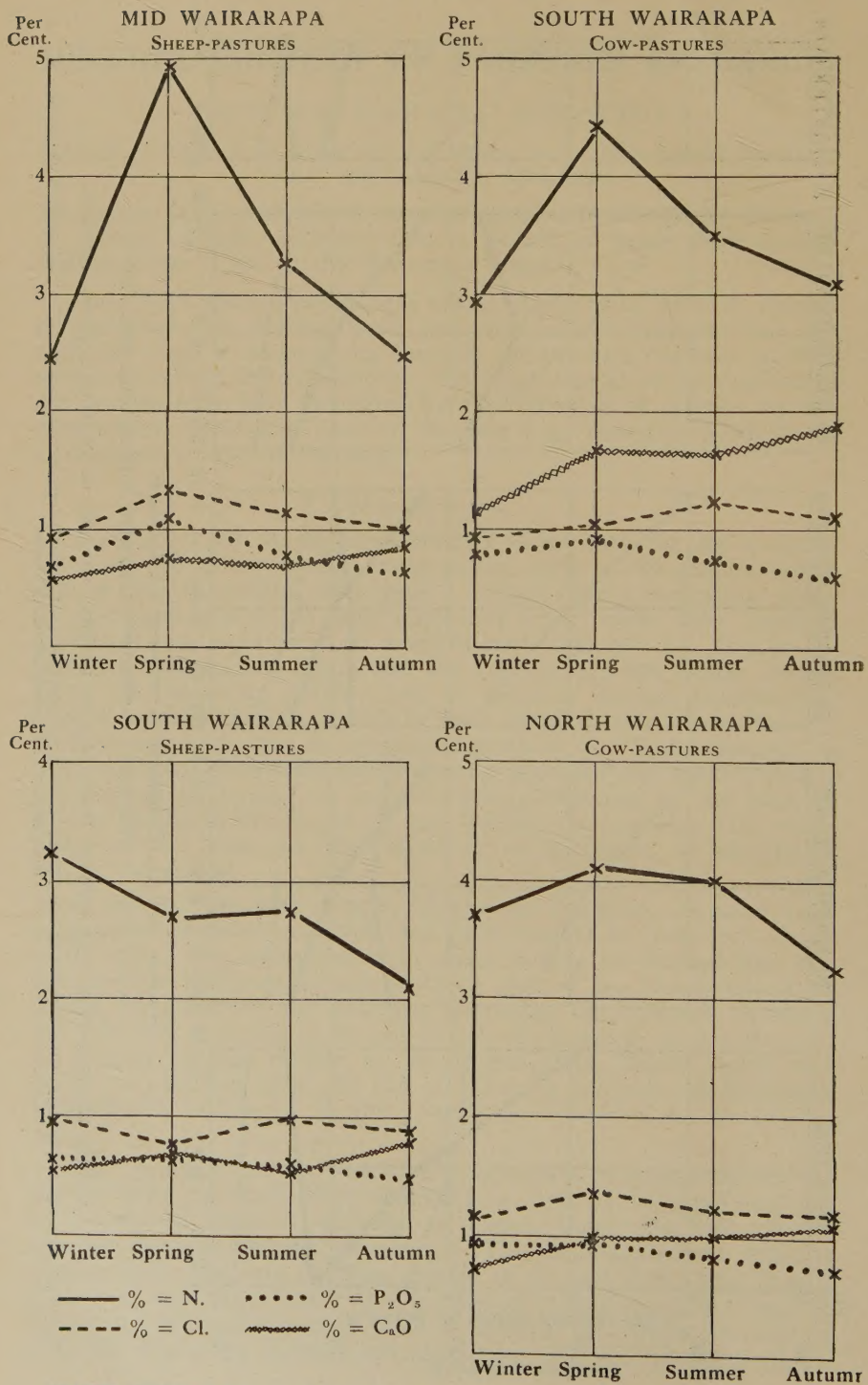
In some of the hilly country sheep-runs deficiency of some kind is being investigated, and this may prove similar to that from which cattle suffer. In connection with sheep it may be recalled that the first deficiency disease in the southern part of the North Island to receive investigation was one in a Wairarapa hilly district, in which the deficiency appeared to be due to lack of phosphoric acid in the soil. An account of this trouble by the investigators, Messrs. Aston and Reid, was published under the title of "Osseous Cachexia: A Malignant Bone-disease of Sheep," in the *Journal of Agriculture* for November, 1910.

The chemical analysis points to a deficiency of phosphates in the soil as being the outstanding deficiency in most of the types analysed in the present research, although, of course, there exist rich alluvial soils on many of the fluviatile flats. The lime-requirement figure is usually fairly low, and the lime content of the soil shows that lime is present in fair proportion. One is relieved to learn on inspecting the figures for soil analysis that there is nothing very much the matter with the Wairarapa district that cannot be remedied by means of the



GRAPHS SHOWING EFFECT OF CLIMATE (RAINFALL) ON MINERAL CONTENT OF CERTAIN SUMMER PASTURES.

"A," unmanured cow-pasture; "B," limed and manured cow-pasture; "C," unlimed manured cow-pasture on same farm as "B"; "D," unlimed unmanured cow-pasture; "E," unmanured sheep-pasture.



GRAPHS SHOWING SEASONAL VARIATIONS IN MINERAL CONTENTS OF PASTURES.

usual method of top-dressing with phosphates. In the majority of localities the necessity for liming is not nearly so marked as is the urgent need for phosphates.

Pasture Results.

The pastures show evidence of decided deficiency of phosphoric acid in all seasons except spring, but in South Wairarapa phosphoric acid in the sheep-pastures is always deficient in any season. In the Martinborough locality there is, in addition to a pronounced deficiency in the phosphoric-acid content of the sheep-pastures, a decided calcium deficiency coincident with low nitrogen content and a high manganese content. Some Masterton hill sheep-country is also low in calcium and protein (nitrogen), in addition to phosphorus.

The impression left on one's mind after a careful scrutiny of the facts is that the phosphate deficiency in the Wairarapa pastures is more due to droughty summers and autumns than to any inherent defect in the soil or the class of pasture. That it is more a seasonal than a continuous deficiency is another circumstance supporting the idea that the unevenly distributed rainfall may be to blame for much of the trouble with stock.

Effect of Climate (Rainfall).

One of the most interesting results of the Wairarapa work is in regard to the decided influence of the amount of rainfall on the composition of the pasture in the seasons of the different years. It was found in each case of four different localities, sampled regularly in three different consecutive summers, that the summer (1927–28), with the lowest rainfall (between 6 in. and 9 in.) produced pasture in which the phosphoric acid was lowest (average 0·33 per cent.), and that the summer (1929–30) in which the rainfall was highest (18 in. to 31 in.) produced pasture in which the phosphoric acid was highest (average 0·63 per cent.), while the intervening summer (1928–29) with an intermediate rainfall (10 in. to 17 in.) produced pasture in which the phosphoric acid was also intermediate (average 0·49 per cent.) between those figures afforded by the two exceptional seasons. This generalization was found to be true in every one of the four localities—Atea, Hamua (two localities), and Mauriceville.

It should be noted that the nitrogen content of the pasture was found to vary correspondingly with the phosphoric-acid content. That this was only to be expected follows from the fact that phosphate is a controlling factor in protein synthesis by the plant, as has been pointed out by Page and Greenhill. It follows, therefore, that during a wet summer in the Wairarapa the percentage of phosphorus in the pasture is not only itself higher, but the amount of protein, the most expensive food-constituent of the animal, is also proportionally increased. The effect of rainfall on the lime content of the pasture was found usually to vary in the opposite direction to that of the phosphoric acid and nitrogen, the percentage of lime decreasing with increase of rainfall.

Effect of Season.

The general trend of the phosphoric-acid and nitrogen content of the Wairarapa pastures is to increase rapidly to the maximum in the

spring, falling with the summer, and reaching the lowest figure in the autumn. Calcium (lime), on the other hand, is lowest in the winter and increases with the progress of the seasons, giving the maximum figures in the autumn.

The most exceptional result of the maximum nutritive value of the pasture occurring in the winter quarter in the case of the South Wairarapa (Martinborough) sheep-pastures is no doubt due to the rainfall being heaviest in that quarter and causing a quick response in a warm droughty soil.

Farm Treatment recommended as a Result of the Investigation.

Generally speaking, phosphate (especially superphosphate) applications may be expected to give remunerative returns on all Wairarapa lands, rich or poor. The necessity for lime would not appear to be nearly so widespread. Some districts are, however, notably deficient in both these important aids to fertility and health.

If top-dressing pastures with phosphates cannot immediately be resorted to as a cure for deficiency diseases in stock—and sometimes it cannot be availed of as a remedy, for rain is essential to the success of phosphates with pasture—and will not effect improvement until rain comes, the use for ruminants of salt licks containing a large proportion of bonedust or finely ground Nauru phosphate all through the year will prove an efficient remedy for the sudden drop in the phosphate content in the summer and autumn pastures.

General.

The writers of the paper acknowledge the great help that has been afforded by Dr. Kidson, Dominion Meteorologist, in this study. His Office is publishing much valuable matter of the greatest value in the study of agricultural problems, and his prompt and willing aid in any investigation is much appreciated.

The paper is illustrated with a number of graphs, some of which are here reproduced

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PERENNIAL RYE-GRASS THRESHING-MILL WASTE.

Several samples of blowings from threshing-mills have been received lately with inquiries as to the value of the material. The type and quality of the samples naturally varies considerably, but the conclusion is that there must be a fair percentage of good rye-grass left in the mill dumps. One good example is shown in the following sample, described as "blowings" from a one-year stand, to be had "merely for the bagging": Pure seed (small-seeded perennial rye-grass), 65·1 per cent.; other crop seeds (six species), 0·9 per cent.; weed seeds (five species, mainly goose-grass), 10·2 per cent.; inert matter, 23·8 per cent: total, 100 per cent. Germination (of the pure seed), 97·0 per cent. Pure germinated seed, 68·0 per cent. Without taking into account the detrimental value of 10 per cent. of goose-grass, &c., on present values the sample is worth as rye-grass approximately 5s. per bushel. The matter of mill waste is being further investigated.

—*Seed-testing Section, Plant Research Station.*

NOTES ON THREE INSECT PESTS.

WILLOW-LEAF SAW-FLY, CYCLAMEN WEEVIL, AND CUTWORM.

J. MUGGERIDGE, B.Sc., Entomologist, Plant Research Station, Palmerston North.

IN these notes mention is made for the first time of a recently introduced willow-leaf saw-fly, *Pontania proxima* Lep. A brief account of the life-history and control of the cyclamen weevil, *Otiorrhynchus (Brachyrhinus) sulcatus* Fab., is also given as being of interest to orchardists. Attention is drawn to the cutworm *Melanchra mutans* Walk., which has become an occasional orchard-pest.

WILLOW-LEAF SAW-FLY.

Pontania proxima Lep. *(Nematus capreae)* is a hymenopterous saw-fly of the Tenthredinidae family (Fig. 1). It is an old-world species of insect which has become well established in New Zealand only within the last few years. As yet its depredations appear to be confined to willows of the South Canterbury districts in the

FIG. 1. PONTANIA PROXIMA. MAGNIFIED ABOUT SIX TIMES. [*Original.*

neighbourhood of Timaru and Temuka and in the vicinity of the Rangitata River. The first specimens of infested willow-leaves were received here in January, 1929, but, unfortunately, no adult insects were reared from this material. From material received in January, 1930, however, the adult saw-flies were reared, and specimens were despatched to the Imperial Institute of Entomology, London, where they were identified as *P. proxima.*

Injury to the willows results in the formation of galls on the leaves, giving them an unsightly appearance (Fig. 2). The galls are whitish wart-like protuberances, and measure approximately $\frac{1}{4}$ in. to $\frac{3}{8}$ in. long and about $\frac{1}{8}$ in. wide. Their formation is due, according to Beyerinck,* to an albuminous secretion containing an enzyme which is injected into the leaf at the time of oviposition.

* General Text-book of Entomology, 1925, p. 546.

This view is supported by the fact that the gall develops before the egg hatches, and will develop even though the egg be killed. The larva is a small greenish grub about $\frac{3}{16}$ in. to $\frac{1}{4}$ in. long with a dark head-capsule, three pairs of thoracic legs, and six pairs of abdominal pro-legs. The larva lives within the gall, and its only communication with the exterior is through a small hole at one end of the gall, through which excrement is passed. To pupate the larva emerges from the gall and spins a small tough and closely woven silken dark-brown

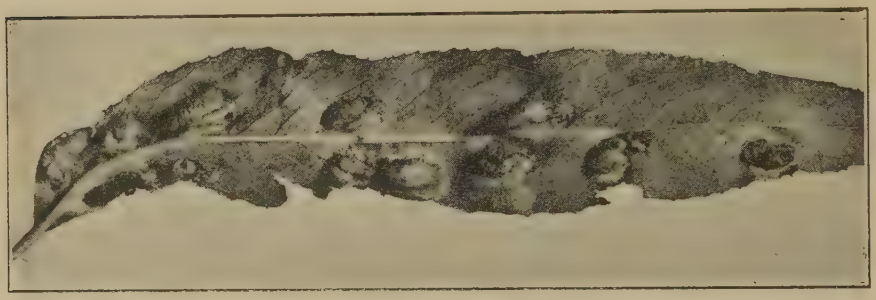

FIG. 2. GALLS ON WILLOW-LEAF CAUSED BY PONTANIA PROXIMA. NATURAL SIZE.

FIG. 3. COCOONS OF PONTANIA PROXIMA SECURED TO WILLOW-LEAF. NATURAL SIZE.

[*Photos by H. Drake.*

cocoon, which it firmly secures to the leaf-surface (Fig. 3). How many broods of this insect occur during a year and how serious a pest it might become the writer is unable to say at present.

Cyclamen Weevil.

Otiorrhynchus (Brachyrhinus) sulcatus Fab., commonly referred to in other countries as the black vine weevil or cyclamen weevil, is probably a far more common pest than is generally considered. The first mention of *O. sulcatus* in this country that the writer is aware of is contained in Department of Agriculture Leaflet for Gardeners and Fruitgrowers No. 15, by T. W. Kirk, published in 1896. This writer states that it was not until 1889 that the insect was brought under his notice as causing destruction to vegetation in New Zealand.

Since 1896 the weevil has been studied a good deal in other countries, and the present account is more or less a review of some of the literature and of some of the most recent methods of control. At least thirty host-plants have been recorded. These include plants such as blackberry, raspberry, loganberry, peach, strawberry, and vines in the field, and cyclamens, primroses, gloxinias, and ferns in the greenhouse,

FIG. 4. ADULT CYCLAMEN WEEVIL. MAGNIFIED ABOUT FOUR TIMES.
[*Original.*

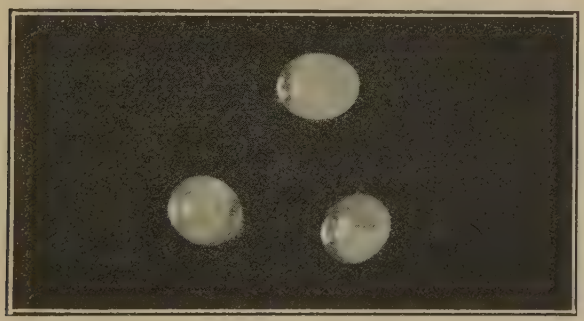

FIG. 5. EGGS OF CYCLAMEN WEEVIL. MAGNIFIED ABOUT TWELVE TIMES.
[*Photo by H. Drake.*

as well as many others. Both the larval and adult stages are injurious, the former attacking the roots of the host and the latter attacking the foliage, flowers, or fruit.

The adult insect (Fig. 4) cannot fly. It is a nocturnal feeder and inactive during the day, when it seeks shelter under rubbish or among the plant stems. According to Smith they reproduce parthenogenetically, and the eggs are found in soil-crevices or among the leaves

or stems of the plant. The eggs (Fig. 5) are pearly white and spherical, but change to a brownish colour in one or two days. The adult larva (Fig. 6) is a whitish legless grub, ½ in. long, and is sparsely covered with hairs. To pupate the larva leaves the host-plant and burrows down into the ground, where it constructs a small earthen cocoon. Pupation takes place in September and October, and emergence of the adults commences in the latter month. The life-history of the insect in New Zealand has not been worked out, but in other countries, such as France, it has definitely a one-year life-cycle, and it is very likely that it has only a one-year cycle in this country.

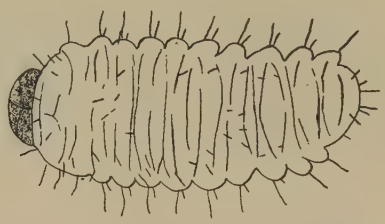

FIG. 6. ADULT LARVA OF CYCLAMEN WEEVIL. MAGNIFIED ABOUT FIVE TIMES.
[*Original.*

Control Measures.—The chief natural enemies of the cyclamen weevil are toads, hedgehogs, and shrews, as well as certain beetles. Notwithstanding these, however, artificial methods must be adopted to keep the pest in proper subjection.

Infestations in the glasshouse may be considerably reduced by hand-picking the adults, but owing to the insect's nocturnal habits this work can be done satisfactorily only at night-time. As a spray, powdered arsenate of lead, used at the rate of 1 lb. to 50 gallons of water, is quite effective, but care must be exercised in its use owing to its tendency to burn, especially when used on tender hothouse plants.

Where a spray cannot be used the following poison bait might be tried: Take some coarsely ground dried apple-peelings and cores (moisture content about 15 per cent.) and add to this five parts of calcium arsenate to ninety-five parts by weight of the ground material, and thoroughly mix. The bait is now ready for use and should be broadcast close to the feeding-places of the adult insects.

Another control method that has recently been tried for protecting pot-plants against the weevil larvæ is to thoroughly mix the potting-soil with lead arsenate, which should be used at the rate of 8 to 12 oz. per bushel of soil. Caution should be exercised, however, if this latter method of treatment is adopted, as it is not known what ultimate effect the lead arsenate may have on many pot-plants.

A Typical Cutworm.

Melanchra mutans Walk. is a typical cutworm and one of the commonest of the Melanchrinae, being very abundant throughout the country. The egg, larval, and pupal stages have been fully described by Quail in Vol. 34, p. 232, of the *Transactions of the New Zealand*

Institute. It is a native species, and it is therefore interesting to note its acquired habit of living on apple foliage and young fruit. Young larvæ (Fig. 7) sent in from the field were reported as having perforated the foliage and buds and bored into the small fruit. The attacks were particularly noted on Jonathans. To rear the larvæ to the adult stage

FIG. 7. YOUNG LARVA OF CUTWORM, MELANCHRA MUTANS. MAGNIFIED ABOUT EIGHT TIMES.

[After Quail.

they were fed on apple-leaves and very young apples. They proved voracious feeders and thrived exceedingly well on the diet. The writer has since observed these insects on apple foliage in the field, but only the younger-stage larvæ were present. In the event of their becoming pests in any locality they should be readily controlled with the lead arsenate spray as used for codlin moth.

TWO OCCASIONAL DEFECTS OF WOOL.

GREEN COLOURATION AND ROTTEN PATCHES IN FLEECE.

R. WATERS, Massey Agricultural College, Palmerston North.

The readiest means of increasing the demand for New Zealand wool is probably that of improving its quality. Apart from the great possibilities for improvement which lie in the direction of breeding, there are prospects of raising the standard of our wool as marketed by various other means, none of which we can afford to neglect. The present note calls attention to certain wool defects not associated with breeding—defects no doubt of relatively minor importance, inasmuch as they are uncommon in occurrence. On the market, however, they seriously affect the value of any line in which they are found. Hence this brief reference to assist in their more general recognition and in the exclusion of affected wool at the sorting-table.

(1) GREEN COLOURATION.

Samples have been received at Massey College of green-stained wool. The locks submitted for examination were thus indelibly tinted in various hands. One correspondent reported the trouble

in "only a small proportion of the fleeces." In another case it had been observed not prior to 1928, and only in sheep pastured on mountain-ranges subject to fogs but not otherwise classed as damp.

Microscopic examination showed the presence of bacteria. The predominant organism was found to be a gram-negative motile rod with the following characters: It liquefied gelatine; formed large spreading greyish colonies with a translucent edge on agar, colouring the medium green; produced marked turbidity, a thick pellicle, and a heavy sediment in broth; reduced nitrates to nitrites and nitrogen, was aerobic, thrived at 37° C., and corresponded in these respects with the description of *Pseudomonas aeruginosa* (Schröter) *Migula*.

This green wool condition coincides with that described by Seddon and McGrath.* They found it of rare occurrence, due to a pigment-producing bacterium, and capable of being reproduced experimentally in the fleece of living sheep. They observed that the bacterium requires much moisture for its growth, that apparently it grows better on fine than on coarse wool, and that the colour when very old turns brownish red. The colour, they found, remained steadfast after scouring, and they were given to understand that buyers looked unfavourably upon green wool for this reason.

(2) Weak or Rotten Wool.

Specimens of wool more or less pink-coloured recently came to hand from two sources. The condition occurred somewhat sparingly and in patches about the fleeces. It extended upward 2 in. from the basal end of the locks. Affected wool was characterized by its pale pink colour, its matted appearance, and its loss of strength—much of it was so rotten as to be useless to the manufacturer.

Microscopic examination showed that the fibres were often united and surrounded by dense masses of bacteria and of wool-cells. The individual fibres tended to lose their form and break up into loose masses of the cells of which the fibres are composed. That the bacteria present were still alive in enormous numbers and capable of resuming activity under suitable conditions was shown by the heavy growths secured in recent sowings of diluted material on culture media.

This condition fortunately does not appear to be very common. The nature of the conditions under which it develops is still a matter for investigation. It is hoped that this note will bring further particulars of its distribution, &c., from other sheep-owners who may have met with it. Obviously any such wool should not be allowed by its presence to depreciate better wool.

The foregoing remarks do not refer to the condition known as "pink-tip." Observations made of pink-tip suggest that it differs in several respects from the pink rotten wool here referred to. The writer would be glad to receive samples of pink-tip from any locality.

* H. R. Seddon and T. T. McGrath: Green Colouration of Wool. *Agric. Gaz. of N.S.W.*, 1929.

MANURING OF EARLY POTATOES.

EXPERIMENTS AT PUKEKOHE IN 1930.

J. E. BELL, Instructor in Agriculture, Fields Division, Auckland.

A COMPREHENSIVE account of experiments conducted in the manuring of early potatoes at Pukekohe, Franklin County, was published in the April, 1930, issue of this *Journal*. These experiments led to the following tentative conclusions in the manuring of early potato crops :—

(1) Quick-acting phosphatic fertilizers, such as superphosphates were more efficient than slower-acting phosphates, such as bonedust and rock phosphates.

(2) Quick-acting nitrogenous fertilizers, such as sulphate of ammonia, were efficient, and gave substantial payable increases.

(3) Potassic fertilizers were of doubtful value.

(4) Indications showed that higher yields were obtained where the manure was placed close to the sets in distribution. Higher yields also resulted where all the superphosphate dressing was applied with the sets than where a portion of the super was delayed for application when the potatoes were through the ground.

THE 1930 EXPERIMENTS.

Further investigations in manuring the early potato crop were carried out in four experiments on four farms at Pukekohe in 1930. The season proved favourable for the growth of early potatoes, the winter months being fairly dry, and, although one or two frosts occurred and the late winter months proved very cold, good crops were secured.

In the following experiments each treatment consisted of a row of potatoes 1 chain long, and was replicated twenty-eight to thirty times. Rows next to ploughing feerings and finishes, and fences, were not included. The Northern Star (Gamekeeper) variety was used in all four trials.

TRIAL ON W. BUTTERY'S FARM.

The field selected for this experiment was broken up in autumn, 1929, from pasture laid down five years previously. Two crops of potatoes had been grown in the 1929–30 season, followed by a catch-crop for green manuring of barley and mustard. The trial was planted and manured on 13th and 15th May, 1930, and the potato sets were planted in the furrow when the green crop was ploughed in.

The trial was laid down to determine the relative merits of phosphates and nitrogen in different forms. The different treatments were :—

(1) Diammonphos 660 lb.
(2) Ammophos (13/48) 500 lb., and Ammophos (20/20) 500 lb.
(3) Superphosphate 15 cwt., and sulphate of ammonia 660 lb.

These three treatments supply approximately the same amounts of phosphate and nitrogen. At no time during growth could any difference be seen between the different treatments. The potatoes were dug and weighed on 2nd and 3rd October, with the following results :—

Table 1.—Results in W. Buttery's Trial.

Treatment.	Yield per Acre.		
	First Grade.	Second Grade.	Total.
	Tons.	Tons.	Tons.
(1) Diammonphos 660 lb.	3·6	0·7	4·3
(2) Ammophos (13/48) 500 lb., and Ammophos (20/20) 500 lb.	3·4	0·7	4·1
(3) Superphosphate 15 cwt., and sulphate of ammonia 660 lb.	3·7	0·7	4·4

In statistical examination Treatment 3 (superphosphate and sulphate of ammonia) proves significantly superior to Treatment 2 (Ammophos) in first-grade and total yield. The differences between Treatments 1 and 2, and also between Nos. 1 and 3, are not significant. It will be seen later from the trial on Mr. E. J. Campbell's farm that the proportion of phosphates and nitrogen in Diammonphos is suitable for the early crop of potatoes, and if the price for this fertilizer, on a unit basis compared with super and sulphate of ammonia, is reasonable its use will effect a considerable saving in freight and labour-handling charges. The same applies to the use of Ammophos, although this fertilizer is not so concentrated as Diammonphos and does not appear quite as efficient.

The price received for first-grade potatoes by the grower in this crop was £28 per ton.

TRIAL ON E. J. CAMPBELL'S FARM.

This trial was carried out on a field broken up from a three-year-old pasture in autumn, 1929. Two crops of potatoes were grown in this field in the 1929–30 season, and the experimental area was planted on 20th May, 1930.

The experiment was laid down to further test the yield value of potash, and to discover the quantities of phosphates and nitrogen most economical to apply. The manurial treatments per acre were as follow :—

(1) Superphosphate 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.

(2) Superphosphate 15 cwt., sulphate of ammonia 2 cwt.

(3) Superphosphate 15 cwt., sulphate of ammonia 4 cwt.

(4) Superphosphate 15 cwt., sulphate of ammonia 6 cwt.

(5) Superphosphate 12 cwt., sulphate of ammonia 6 cwt.

(6) Superphosphate 9 cwt., sulphate of ammonia 6 cwt.

Before digging, the rows most heavily manured with sulphate of ammonia could be picked out quite readily, the tops being heavier. The trial was weighed on 7th and 8th October, with results as shown in the following table :—

Table 2.—Results in E. J. Campbell's Trial.

Treatment.	Yield per Acre.			Increase of First-grade Potatoes over Treatment 2.	Net Value of Increase per Acre over Treatment 2.
	First Grade.	Second Grade.	Total.		
	Tons.	Tons.	Tons.	Tons.	£ s. d.
(1) Super 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.	3·8	0·8	4·6	0·5	6 13 3
(2) Super 15 cwt., sulphate of ammonia 2 cwt.	3·3	0·8	4·1	..	..
(3) Super 15 cwt., sulphate of ammonia 4 cwt.	4·0	0·8	4·8	0·7	12 0 2
(4) Super 15 cwt., sulphate of ammonia 6 cwt.	4·3	0·8	5·1	1·0	16 9 0
(5) Super 12 cwt., sulphate of ammonia 6 cwt.	4·3	0·8	5·1	1·0	17 5 2
(6) Super 9 cwt., sulphate of ammonia 6 cwt.	4·2	0·7	4·9	0·9	16 3 5

The first-grade potatoes were sold for £23 6s. per ton. The last column in the table gives the per-acre value for the increased yield over Treatment 2; the value of the extra manure, extra bags, and cost of digging and carting being deducted from the gross value of the additional table potatoes.

The yield of Treatment 3, containing 4 cwt. sulphate of ammonia, is significantly greater that that of Treatment 2, containing 2 cwt. of sulphate of ammonia, by 0·7 tons of first-grade potatoes, and gives a net profit due to the extra 2 cwt. of sulphate of ammonia of £12 0s. 2d. per acre. Treatment 4, containing 6 cwt. sulphate of ammonia, is better significantly than Treatment 2 by 1 ton of first-grade potatoes, netting a profit of £16 9s. per acre due to the extra 4 cwt. of sulphate of ammonia, but it gives a barely significant increase over Treatment 3. The differences are also significant in the total yields. Yields 4, 5, and 6, containing varying amounts of superphosphate, do not differ to a significant degree.

From a comparison of Treatments 1 and 3 it is seen that, as in the previous year's experiments, potash has proved of no yield value, but the depression due to potash is not statistically significant.

The use of sulphate of ammonia has again proved very effective in increasing the yield, and when used up to 6 cwt. per acre it gives a very payable return. Diminishing the quantity of phosphates from 15 cwt. to 12 cwt. has not affected the yield. Diminishing the quantity to 9 cwt. has not significantly affected the yield. It is apparent that the quantity of phosphates applied can be fairly safely reduced to 12 cwt. per acre.

TRIAL ON G. T. NICHOLSON'S FARM.

This experiment was conducted on a field ploughed out of a five-year-old pasture. The land was in very good heart, with plenty of turf present. The treatments were:—

(1) Superphosphate 15 cwt.
(2) Superphosphate 15 cwt., sulphate of potash 2 cwt.

(3) Superphosphate 15 cwt., sulphate of potash 2 cwt., sulphate of ammonia 4 cwt.
(4) Superphosphate 15 cwt., sulphate of ammonia 4 cwt.
(5) Superphosphate 15 cwt., sulphate of potash 4 cwt., sulphate of ammonia 4 cwt.

The experiment differed from last year's trial on the same farm only in Treatment 5. The plots were planted on 21st and 22nd May, and were dug and weighed on the 13th, 14th, and 15th October, with the following results :—

Table 3.—Results in G. T. Nicholson's Trial.

Treatment.	Yield per Acre.			Increase of First-grade Potatoes over Treatment 1.	Net Value of Increase per Acre over Treatment 1.
	First Grade.	Second Grade.	Total.		
	Tons.	Tons.	Tons.	Tons.	£ s. d.
(1) Super 15 cwt... ..	6·4	0·9	7·3	..	..
(2) Super 15 cwt., sulphate of potash 2 cwt.	6·7	1·0	7·7	0·3	2 12 9
(3) Super 15 cwt., sulphate of potash 2 cwt., sulphate of ammonia 4 cwt.	7·6	1·0	8·6	1·2	12 15 9
(4) Super 15 cwt., sulphate of ammonia 4 cwt.	7·5	1·0	8·5	1·1	12 19 0
(5) Super 15 cwt., sulphate of potash 4 cwt., sulphate of ammonia 4 cwt.	7·5	1·0	8·5	1·1	9 16 6

The rows treated with sulphate of ammonia were observed to grow more vigorously than the rows receiving none of this fertilizer.

In statistical treatment of the results presented in Table 3, Treatment 2 (super, and potash 2 cwt.) gives a significant increase over Treatment 1 (super alone) in total yield, but not in first-grade or second-grade potatoes. Treatment 3 (super, potash 2 cwt., and sulphate of ammonia 4 cwt.) gives a significant increase in first-grade and in total yield over Treatment 2 (super, and potash 2 cwt.), but it gives no significant increase over Treatment 4 (super, and sulphate of ammonia 4 cwt.). Treatment 4 (super, and sulphate of ammonia 4 cwt.) gives a significant increase over Treatment 1 (super alone) in first-grade and total yield.

The use of 2 cwt. of potash has given slight increases, either barely significant or not significant. The use of 4 cwt. of potash has not affected the yield. The use of 4 cwt. of sulphate of ammonia has increased the yield by almost 1 ton of first-grade potatoes, giving a net profit due to the use of this fertilizer of £12 19s. per acre. The first-grade potatoes from the trial area averaged £18 8s. per ton.

TRIAL ON P. A. MILLER'S FARM.

This trial was laid down on a field which was ploughed from a four-year lea in the autumn of 1930, and was planted on 26th May. The treatments were as follows :—

(1) Superphosphate 15 cwt., sulphate of ammonia 4 cwt.
(2) Superphosphate 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.
(3) Superphosphate 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt.

Treatments 1 and 2 were sown in 3 in. bands, the fertilizer being distributed very close to the potato-sets as they were planted in the furrows. In Treatment 3 the fertilizer was sown in a 9 in. to 12 in. band as is the common practice. Germination counts were made on 28th August, when the plants were well through the ground, but these did not show any significant differences in the number of misses or of subnormal plants in the various treatments. Therefore the close application of the fertilizers cannot be said to have affected the strike. At no time during the growing-period could any differences be detected by observation.

The trial was dug and weighed on 26th October, with the following results :—

Table 4.—Results in P. A. Miller's Trial.

Treatment.	Yield per Acre.		
	First Grade.	Second Grade.	Total.
	Tons.	Tons.	Tons.
(1) Super 15 cwt., sulphate of ammonia 4 cwt., in 3 in. bands	6·2	1·0	7·2
(2) Super 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt., in 3 in. bands	6·1	1·0	7·1
(3) Super 15 cwt., sulphate of ammonia 4 cwt., sulphate of potash 2 cwt., in 9 in. to 12 in. bands	5·9	1·0	6·9

The difference in the yields was not significant. In the previous year's trial the application of the fertilizer in 3 in. bands gave a significant increase in yield over the application in 9 in. to 12 in. bands of 0·62 tons of first-grade potatoes per acre. The difference in 1930 is 0·2 tons per acre, and is not significant. It appears that close application of the manurial treatment is advisable, but since the extent to which it affects the yield has differed in the two seasons, nothing definite can be decided till further experimental evidence is gained. The use of 2 cwt. of potash has not given any increase in the yield.

Recommendations to Pukekohe Growers for Early Crops.

(1) Use (*a*) 12 cwt. of superphosphate, plus 4 cwt. to 6 cwt. of sulphate of ammonia, per acre ; or (*b*) 4 cwt. to 6 cwt. of Diammonphos ; or (*c*) 6 cwt. to 9 cwt. of a mixture of equal quantities of Ammophos (20/20) and Ammophos (13/48). The respective prices and cost of handling should determine which is to be used.

(2) The inclusion of about 2 cwt. of potash per acre is an established practice in Franklin County. In the experiments conducted in 1929 and 1930 potash has proved of little value in increasing the yield, under the system of application adopted. It is hoped to gain further information in next season's experiments.

The writer wishes to record his thanks to Messrs. Campbell, Nicholson, Miller, and Buttery for their helpful co-operation in carrying out the 1930 manurial experiments.

SWEDE VARIETY TRIALS IN CANTERBURY.

YIELD-CAPACITY AND DRY-MATTER CONTENT OF VILMORIN'S SWEDE.

Fields Division and Plant Research Station, Department of Agriculture.

VILMORIN'S White-fleshed Purple-top swede (referred to hereafter as Vilmorin's) was introduced into Taranaki by Mr. J. W. Deem in 1921, and grown at the Stratford Demonstration Farm with good results. The following year 1 cwt. of the seed was secured by the Department of Agriculture and distributed in small quantities to farmers in various parts of New Zealand. In the Wanganui-Waverley district this swede has been a favourite ever since. The swede withstood insect attack and dry conditions better than the other more commonly grown varieties.

Mr. F. E. Ward (then Instructor in Agriculture for Canterbury) carried out a preliminary trial with the Vilmorin swede in South Canterbury in the 1925–26 season. The results were sufficiently promising to warrant further trials, which were carried out in the two succeeding seasons (1926–27 and 1927–28) under the following method: One half of the drill or ridging-machine sowed Vilmorin seed, and the other half sowed a standard variety, usually Superlative. The sowing-machine was run up and down the field five to ten times, giving five to ten replications of each variety. Weighings were taken when the crops were mature. The results are tabulated below:—

Table 1.—Yields of Vilmorin's Swede compared with Yields of Standard Variety.
(In most cases the standard variety was Superlative. Yields include weight of roots plus tops.)

Name of Farmer and Location.	Season of Trial.	Yields in Tons per Acre.		Difference in favour of Vilmorin's.
		Vilmorin's.	Standard Variety.	
(1) J. Carr, Methven ..	1926–27	20·6	14·7	5·9
(2) R. J. Low, Highbank ..	1926–27	22·7	15·0	7·7
(3) R. J. Low, Highbank ..	1927–28	22·4	18·4	4·0
(4) G. E. Benny, Southbridge	1927–28	48·3	42·6	5·7
(5) W. and A. Campion, Prebbleton	1927–28	38·4	34·4	4·0
(6) K. Murchison, Kirwee ..	1927–28	18·6	15·1	3·5
(7) W. Barnett, Morven ..	1927–28	28·4	21·4	7·0
(8) E. Stokes, Morven ..	1927–28	48·4	38·3	10·1
(9) J. H. Milne, Waihao Downs	1927–28	32·3	25·8	6·5
(10) R. Sinclair, Morven ..	1927–28	32·3	25·8	6·5

Average difference in favour of Vilmorin's, 6·1 tons per acre. The increase in every case is statistically significant.

In these trials the Vilmorin swede invariably produced a more vigorous top, less susceptible to attack by aphis and diamond-back moth. As a rule, the roots of the Vilmorin were rather more forked and deeper in the ground. This is a disadvantage where the roots are

pulled by hand, but when fed off by stock this feature is not likely to matter. There were no marked differences in the keeping-qualities of the swedes under trial.

Dry-matter Content.

Mr. M. J. Scott and Mr. D. J. Sidey, Chemist and Assistant Chemist respectively at Canterbury Agricultural College, Lincoln, carried out determinations of the dry-matter content of the varieties in Trials 3, 4, and 5 (Table 1). The varieties with which Vilmorin's were compared were: Trial 3, Superlative; Trial 4, Elephant; Trial 5, Superlative and Elephant. Roots were taken from Trials 3, 4, and 5 during June and July, and from Trials 3 and 4 on 10th August and 1st September, respectively. Ten large, ten medium, and ten small-sized roots were sampled on each occasion, except from Trial 5 on 1st September, when only three large and three medium-sized roots were sampled. A report furnished by Messrs. Scott and Sidey is summarized as follows:—

"The average dry-matter content of swedes pulled in June and July are shown in the following table:—

Table 2.—Average Percentages of Dry Matter in Roots pulled in June and July.

Size of Roots.	Vilmorin's.		Other Varieties.	
	Number of Roots sampled.	Percentage of Dry Matter.	Number of Roots Sampled.	Percentage of Dry Matter.
Large	29	8·35	37	7·52
Medium	30	8·68	38	8·55
Small	28	10·44	37	10·66

"The results were submitted to statistical examination. The difference of 0·83 per cent. of dry matter in favour of Vilmorin's in the large roots is significant, and represents 11 per cent. more dry matter than is contained in the other varieties. The differences in medium and small-size Vilmorin's and the corresponding sizes of the other varieties are not significant.

"The average dry-matter content of swedes pulled in August and September are shown in Table 3.

Table 3.—Average Percentages of Dry Matter in Roots pulled in August and September.

Size of Roots.	Trial Number in Table 1.	Vilmorin's.		Other Varieties.	
		Number of Roots Sampled.	Percentage of Dry Matter.	Number of Roots Sampled.	Percentage of Dry Matter.
Large	3	10	10·1	10	8·9
Medium	3	9	10·2	10	8·9
Small	3	10	10·8	..	..
Large and medium mixed ..	4	6*	10·6	6	10·5

* Two samples were taken from each root, giving twelve samples for analysis.

"The differences of 1·2 and 1·3 per cent. in the dry matter in favour of Vilmorin's large and medium sizes in Trial 3 are significant,

and represent about 14 per cent. more dry matter than is contained in the other varieties. The difference between Vilmorin's and the other variety in Trial 4 is not significant."

Conclusions.

In districts where swedes are grown in Canterbury it is obvious that Vilmorin's White-fleshed Purple-top variety is worth trying. It has given consistently higher yields than the varieties with which it has been compared, and in some cases has produced roots with a higher dry-matter content than these varieties. Its only disadvantage where the crop is pulled is its tendency to "fangy" and deep rooting.

Note.—Mr. R. McGillivray (this *Journal*, July, 1927, p. 47, and August, 1928, p. 122) has also reported on trials of Vilmorin's swede at Gore Experimental Area, in which this variety outyielded others under test.

Thanks are due to the farmers who co-operated in these trials, and to Messrs. Scott and Sidey for their valuable assistance in carrying out the dry-matter determinations.

—*A. W. Hudson, Crop Experimentalist, Plant Research Station.*

MOTTLED COLOUR IN CHEESE.

INVESTIGATIONS IN SOUTH AUCKLAND DISTRICT.

W. H. Udy, Chief Chemist, Hamilton Dairy Research Laboratory.

A considerable amount of coloured cheese made in New Zealand suffers in grade due to an unevenness of colour. This is shown in the form of a seamy or a mottled appearance on drawing a plug. The discoloration varies in intensity and hue, being sometimes almost white. Sometimes the discoloration apparently follows the surfaces of the curd-particles.

Investigation of this defect has been made from time to time in the New Zealand Co-operative Dairy Company's Research Laboratory, at Hamilton, and the main cause of the defect is looked upon as being due to development in the cheese of organisms which cause a reduction of the cheese colour. The defect occurs more commonly in the hot weather, and generally develops on holding the cheese in storage. A large number of organisms have been studied as to their effect on cheese-colour, and a gram negative bacillus has been isolated from discoloured cheese which readily bleaches cheese-colour in annatto agar media.

The need for good-quality milk and sanitary conditions of cheese-manufacture are suggested as the most important means of overcoming this defect.

Effect of Exposure to Sunlight.

As the result of observations by a factory-manager recently investigations have been made as to the effect of direct sunlight on the milk and curd in the vat, and it has been found that this is an important cause of mottled colour. As little as five minutes' direct sunshine playing on the surface of milk with annatto added, in a vat while setting, gave the surface a distinctly lighter colour than the remaining curd. Thirty minutes' direct sunshine gave an almost white surface. This curd, after cutting and mixing into the remainder of the curd, gave a definite mottleness.

Direct sunlight playing on the curd in the whey after cutting also proved effective. Sunlight shining down through several inches of whey on to curd at the bottom of a tinned container for half an hour gave distinct discoloration. Moist whey-soaked curd exposed to direct sunlight showed distinct discoloration in five minutes, and was quite bleached in thirty minutes. This bleaching penetrated to a considerable depth into the curd particle.

Direct sunlight playing on the milk in the vat during setting, or on the curd in the whey or later, is therefore proved to be a cause of mottleness in colour.

A survey was made of the amount of exposure of milk and curd to sunlight and the incidence of mottled colour at a number of different cheese-factories during the 1930–31 summer months. It was found that exposure in the vats to direct sunlight was common. In one factory with six vats two only of the vats were exposed to an appreciable amount of sunlight, and of a large number of vats graded down for mottled colour practically all were from these two vats.

In discussing the action of sunlight in discolorizing cheese-curd it has to be remembered that light is made up of different rays, only some of which are chemically effective. A large proportion of these effective rays will pass through clear glass, but coloured or dust-covered glass would greatly diminish this proportion. Diffused sunlight will have very little action. The trouble due to exposure to sunlight should therefore be readily overcome by painting the glass so that only diffused light is used.

Food Values and Iodine-metabolism Research.—The Chairman's address at the last meeting of the Research Council, in Wellington, included the following reference to this subject: "Good progress has been made in a number of investigations into (1) the nutritive value of cheese protein and its vitamin efficiency, (2) the Vitamin C content of milk, and (3) iodine metabolism, by various workers conducting their researches under the direction of Dr. J. Malcolm at the Otago University. Such work is fundamental to our dairy industry and has immediate practical application. To indicate some of the findings will exemplify this point. It has been found that pasteurization does not adversely affect the Vitamin D content of New Zealand cheese, and that summer cheese is an excellent source of this vitamin. As contrasted with butter, where apparently a considerable loss occurs during milk-separation in winter months, the seasonal fluctuation in Vitamin D content of cheese is much less. It has also been demonstrated that a definite relationship exists between calcium and iodine in so far as these participate in food metabolism within the bodies of animals consuming any particular diet."

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR YEAR 1930.

N. R. Foy, Seed Analyst, Plant Research Station, Palmerston North.

For the calendar year 1930 10,461 seed-samples were received at the Department of Agriculture's Seed-testing Station at Palmerston North, representing an increase of 1,308 on the number received during the previous year. This increase was almost wholly accounted for by commercial samples.

The accompanying tables 1, 2, 3, 4, and 5 show the distribution, origin, classification, &c., of the various samples. The samples shown for Government Departments and the Fields Division in Table 1 represent mainly check samples on seed purchases, and those for the Plant Research Station consist of special Seed-station tests, together with samples from the Mycological Laboratory, Agrostologist, Agronomist, &c., in connection with their various investigational activities.

Table 1.—Origin of Samples received, 1930 and 1929.

Senders, &c.	Number of Samples.	
	1930.	1929.
Seed-merchants	8,856	7,827
Farmers and seed-growers	190	138
Government Departments (other than Agriculture) ..	130	67
Massey Agricultural College	247	..
Agriculture Department—		
Fields Division	141	99
Plant Research Station	642	879
Retests	255	143
Totals	10,461	9,153

Table 2.—Number of Samples received each Month, 1930 and 1929.

Month.	Number.		Month.	Number.	
	1930.	1929.		1930.	1929.
January	578	483	July	932	1,007
February	773	754	August	1,199	833
March	1,251	835	September	1,181	891
April	807	1,118	October	847	728
May	1,276	1,008	November	483	579
June	831	638	December	303	279

Table 3.—Classification and Numbers of Samples and Tests, 1930 and 1929.

Classification.	Number.	
	1930.	1929.
Samples for purity and germination ..	3,889	3,101
Samples for purity only	133	89
Samples for germination only ..	6,439	5,953
Purity tests made	4,022	3,190
Germination tests made	10,328	9,054
Total tests	14,350	12,244

Table 4.—Number of Samples from Land Districts and Centres therein, 1930 and 1929.

Land District, &c.	1930.	1929.	Land District, &c.	1930.	1929.
Southland (total) ..	**2,721**	**2,258**	Hawke's Bay ..	**700**	**307**
Gore	1,392	1,235	Gisborne	**24**	**17**
Invercargill ..	1,326	977	Taranaki	**416**	**438**
Other	3	46	Auckland (total) ..	**1,042**	**1,093**
Otago (total)	**924**	**814**	City	934	1,013
Dunedin	860	725	Other	108	80
Other	64	89	North Auckland ..	..	**1**
Canterbury (total) ..	**1,117**	**947**	Overseas	57	40
Christchurch ..	581	555			
Other	536	392			
Marlborough ..	**184**	**104**			
Wellington (total) ..	**1,671**	**1,950**			
City	649	1,061			
Palmerston North and Feilding	790	629			
Other	232	260			

Table 5.—Number of Samples of various Seed Species reported on in 1930 and 1929 and Number of Tests made thereon in 1930 (excluding Special Station Tests).

Species.	1930.			1929.
	Purity Tests.	Germination Tests.	Samples.	Samples.
Grasses.				
Perennial rye-grass (*Lolium perenne*) ..	324	2,260	2,272	1,600
Italian rye-grass (*Lolium multiflorum*) ..	64	324	324	287
Western Wolths rye-grass (*Lolium westwoldicum*)	16	184	184	146
Cocksfoot (*Dactylis glomerata*)	162	440	442	438
Crested dogstail (*Cynosurus cristatus*) ..	656	874	897	770
Chewings fescue (*Festuca rubra* var. *fallax*) ..	794	1,006	1,035	722
Brown-top (*Agrostis tenuis*)	852	833	852	627
Danthonia pilosa	17	45	45	62
Timothy (*Phleum pratense*)	54	97	97	89
Fog (*Holcus lanatus*)	32	38	38	42
Meadow-fescue (*Festuca pratensis*)	6	15	15	31
Meadow-foxtail (*Alopecurus pratensis*) ..	40	40	40	52
Paspalum (*Paspalum dilatatum*)	10	87	87	124

Table 5—continued.

Species.	1930. Purity Tests.	1930. Germination Tests.	1930. Samples.	1929. Samples.
Grasses—continued.				
Poa pratensis	20	37	37	38
Poa trivialis	4	17	17	12
Prairie-grass (*Bromus unioloides*)	3	27	27	22
Red-top (*Agrostis palustris*)	0	9	9	8
Yarrow* (*Achillea millefolium*)	7	17	17	33
Other grasses, &c.	6	24	24	21
Totals	3,067	6,374	6,459	5,124
Clovers, &c.				
White clover (*Trifolium repens*)	354	487	523	334
Red clover (*Trifolium pratense*)	178	404	412	296
Alsike (*Trifolium hybridum*)	24	69	69	63
Alsike and white clover (mixed)	11	32	32	26
Subterranean clover (*Trifolium subterraneum*)	9	37	37	35
Strawberry clover (*Trifolium fragiferum*)	..	5	5	10
Crimson clover (*Trifolium incarnatum*)	1	19	19	33
Suckling clover (*Trifolium dubium*)	15	28	28	37
Lucerne (*Medicago sativa*)	5	50	50	89
Trefoil (*Medicago lupulina*)	4	21	21	27
Lotus major	23	47	48	77
Lotus hispidus	9	16	17	24
Other clovers, &c.	12	30	31	18
Totals	645	1,254	1,292	1,069
Roots and Cruciferous Forages.				
Swede (*Brassica campestris*)	12	231	231	253
Turnip (*Brassica rapa*)	19	337	337	355
Rape (*Brassica napus*)	2	116	116	110
Kale (*Brassica acephala*)	2	82	82	82
Mustard (*Brassica arvensis*)	1	19	19	20
Mangel (*Beta vulgaris*)	9	182	182	248
Carrot (*Daucus carota*)	4	79	79	118
Totals	49	1,046	1,046	1,186
Cereals, Vegetables, &c.				
Oats (*Avena sativa*)	..	65	65	24
Wheat (*Triticum vulgare*)	..	24	24	54
Barley (*Hordeum vulgare*)	..	27	27	27
Ryecorn (*Secale cereale*)	..	7	7	13
Vetches (*Vicia* spp.)	..	2	2	3
Peas (*Pisum sativum*)	..	220	220	161
Japanese millet (*Echinochloa frumentacea*)	..	18	18	27
Other forages	..	13	13	64
Vegetable seeds (other than peas)	5	369	369	398
Flower seeds	..	43	43	90
Forest-tree seeds	..	2	2	31
Seed mixtures	16	42	42	26
Totals	21	832	832	918

* Included here for convenience.

Table 6.—Number of Samples tested for Purposes of the Canadian Seeds Act and Probable Grading thereof.

Species.	Number of Samples examined.	Grade No. 1.	Grade No. 2.	Grade No. 3.	Rejected.
Red clover	98	40	32	24	2
Chewings fescue	6	6	..	..	..
Brown-top	2	2	..	..	..
Perennial rye-grass ..	1	1	..	..	..
Crested dogstail	1	1	..	..	..

GRASS-SEEDS.

Tables 7 and 8 present various aspects of germination and purity in the main species of grasses.

Rye-grass.—The germination of the seed from all districts was lower than that for the previous year, and consequently well below what may be termed fair average. Canterbury seed gave the highest average of 78 per cent., more than half the samples germinating over 80 per cent. Of the samples from all other districts 40 per cent. or over germinated below 70 per cent. All of the 1930 certified perennial rye-grass was produced in the North Island East Coast districts, and, so far as germination was concerned, was very disappointing. The seed, however, was in short supply, and, notwithstanding the fact that

Table 7.—Average Germination and Percentage of Seed Impurities in the Main Grass Species, 1930.

Species.	Percentage of Germination.				Percentage of Samples germinating in Groups—					Average Percentage of Seed Impurities.	
	Average.		Maximum.	Minimum.	Below 60.	60–69.	70–79.	80–89.	90–100.	Crop.	Weed.
	1930.	1929.									
Perennial rye-grass ..	70	81	99	9	19	21	32	21	7	0·8	1·0
Italian rye-grass ..	75	79	100	18	11	20	23	24	22	0·6	0·5
Western Wolths ..	73	77	95	12	14	18	27	30	11	0·1	0·5
Cocksfoot	68	67	95	7	20	25	36	15	4	7·4	0·6
Crested dogstail ..	88	94	100	2	1	5	7	25	62	1·0	0·2
Chewings fescue ..	81	91	98	1	4	8	13	45	30	0·7	0·2
Brown-top* ..	95	93	100	34	1	1	1	5	92	0·2	0·5
Timothy	89	85	100	63	1	4	7	20	68	0·2	0·4
Fog	90	94	99	81	..	..	..	12	88	7·0	1·6
Poa pratensis ..	61	50	84	40	39	33	25	3	..	0·2	0·5
Meadow-foxtail ..	46	21†	70	..	68	25	5	2	..	2·6	2·8
					0–29	30–39	40–49	50–59	60–100		
Danthonia spp. ..	49	29	87	1	27	7	17	9	40	2·8	10·4
Paspalum	23	33	64	..	67	14	9	6	4	0·3	0·5

* Percentage germination of the pure seed (International rules); see Table 9. † Percentage germination on unblown samples.

Table 8.—Average Percentage of Germination and Seed Impurities of the Main Grass-seeds grouped according to Origin, 1930 and 1929.

Samples.	Average Percentage of Seed Impurities.	Percentage of Samples germinating in Groups—								Average Percentage of Germination.		Number of Samples.	
		Below 70.		70–79.		80–89.		90–100.					
		1930.	1929.	1930.	1929.	1930.	1929.	1930.	1929.	1930.	1929.	1930.	1929.
Perennial Rye-grass.													
All samples	1·8	40	15	32	17	21	37	7	31	70	81	2,136	1,592
Southern*	1·0	40	6	38	14	19	41	3	39	72	85	996	797
Canterbury	2·3	25	20	22	23	33	33	20	24	78	80	197	258
Sandon ..	2·3	82	18	9	16	1	28	8	38	48	82	86	127
Hawke's Bay	5·0	46	24	28	25	21	34	5	17	67	76	543	223
Poverty Bay	5·1	70	55	16	12	7	21	7	12	59	67	82	51
Certified†	3·5	45	..	33	..	16	..	6	..	68	..	119	..
Cocksfoot.													
All samples	8·0	45	39	36	33	15	23	4	5	68	67	434	430
Danish ..	4·8	44	20	36	50	20	24	..	6	68	74	52	78
Akaroa ..	4·7	51	54	36	32	10	12	3	2	70	69	86	115
Plains ..	8·5	46	34	25	28	20	28	9	10	71	74	107	55
Crested Dogstail.													
All samples	1·2	6	1	7	3	25	8	62	88	88	94	871	747
Chewings Fescue.													
Southern (a.s.)	0·9	12	2	13	6	45	12	30	80	81	91	1,003	697
Brown-top.													
All samples	0·7	1	1	2	5	5	8	92	86	95	93	750	627
Certified‡ ..	0·4	..	..	..	..	3	..	97	..	97	..	83	..

* Grown in Southland and Otago. † Hawke's Bay. ‡ Southern and Canterbury.

Table 9.—Average Percentages of Pure Seed, Germination, &c., of Samples tested according to International Rules (provisional).

Seed.	Purity.				Percentage of Germination of Pure Seed.	Percentage of Pure Germinating Seed.
	Pure Seed.	Other Crop Seed.	Weed-seed.	Inert Matter.		
Perennial Rye-grass—						
Certified seed ..	96·9	1·2	2·3	0·5	68·3	65·9
Brown-top—						
All samples ..	97·1	0·5	0·7	1·7	94·5	92·1
Certified seed ..	98·8	0·1	0·4	0·7	96·8	95·8
White clover—						
Certified seed* ..	93·1	4·6	0·9	1·4	82·8	78·1
Red clover† ..	99·4	0·2	0·1	0·3	93·7	92·2
Meadow foxtail ..	48·0	2·6	2·8	27·4	46·3	23·5

* Certified "old pasture." † Tested for purposes of Canadian Seeds Act.

the germination of various lines ranged from 30 to 90 per cent., in the eyes of the buyers all seed was considered equal, and was disposed of at high prices.

Until the South Island can produce sufficient seed to bring the price to a normal figure, the presence of the official tag and seal will no doubt satisfy most purchasers that they are securing full value for the price asked. Actually this is quite an erroneous view, as the presence of the tag and seal signifies that the seed has been produced from parent plants of definite types, and it has no significance in so far as "seed quality" is concerned. Sealed sacks may contain seed of a high or a low germination, or of a high or a low purity, and, although quoting purity and germination percentages may be contrary to the practice of the seed-vendor, it should be borne in mind that the provision of certificates of purity and germination for every machine-dressed line is an essential feature of seed certification, and that it is intended that purchasers, wholesale or retail, should be allowed the opportunity of ascertaining the percentages of purity and germination of any certified line under consideration.

Awned seeds (" tailed ") of Italian rye-grass occurred in 70 per cent. of all the samples of perennial examined, in 76 per cent. of Southern, in 75 per cent. of Canterbury, in 31 per cent. of Hawke's Bay (uncertified), in 33 per cent. of Poverty Bay (uncertified), and in 6 per cent. of the certified samples. These percentages may be considered a minimum, as in machine-dressing a number of the awns are broken off, and seeds of Italian are then practically indistinguishable from those of perennial.

The purity of certified rye-grass was on the whole good; the 2·39 per cent. of weed-seed shown in Table 9 consisted mainly of goose-grass (*Bromus hordeaceus*) and hair-grass (*Festuca bromoides*).

Cocksfoot.—The average germination of cocksfoot was in all groups about the average. The percentage of seed impurities, however, was higher than usual for Danish and Akaroa—4·8 and 4·7 per cent. respectively. In practically all samples the impurity concerned was rye-grass and not weed-seeds. A few samples were tested according to International rules, with the following average results, expressed as percentages: Pure seed, 77·6; other crop-seed, 8·5; weed-seed, 0·1; inert matter, 13·8; germination, 86·0; pure germinating seed, 66·9.

Chewings Fescue.—The 1930 crop of this fescue was grown and harvested under most unsuitable and unseasonable climatic conditions, and in consequence it was not up to the usual standard, heavy-weight seed of good appearance being extremely rare. The germination was not up to average, being 10 per cent. below that for the previous year. Only one-third of the samples germinated over 90 per cent., compared with 80 per cent. of the samples for 1929. As was anticipated, the seed generally did not ship well, and a considerable number of complaints have been received from overseas buyers in consequence. It is considered, however, that allowance should be made for an occasional " off " season, and that, given normal conditions, Chewings fescue will ship as satisfactorily as it has done during the past five or six years.

Crested Dogstail.—The 1930 crop of dogstail was also below average in quality, only 42 per cent. of the samples germinating in the

90's, compared with 88 per cent. for the previous year. Actually this is more significant than the depression of 6 per cent. in the general average. Californian thistle (*Circium arvense*) occurred in 40 per cent. of the samples examined, at the average rate of ten seeds per ounce.

Brown-top.—All the season's brown-top was of a particularly high quality. The average percentage of pure seed was higher than for the previous year, the average percentage of inert matter having been reduced by 1 per cent. Of the certified samples tested 97 per cent. germinated 90 per cent. or over.

Other Grass-seeds.—The average germinations of the grass-seeds not included in Table 7 are as follow:—

	Per Cent.		Per Cent.
Meadow-fescue	77	Red-top	87
Poa trivialis	64	Yarrow	52
Fiorin (*Agrostis stolonifera*) ..	75	Indian doob (*Cynodon dactylon*)	80
Ratstail (*Sporobolus indicus*) ..	68	Poa nemoralis	76

Clovers and Related Species.

The average percentages of germination and purity of the main clover-seeds, &c., are shown in Table 10.

White Clover.—The average percentages of seed impurities and germination for all samples are much on a par with those for previous years. Through the increase in the percentage of other crop seeds—mainly suckling clover—the pure seed content of certified seed was 2 per cent. lower than for 1929. Most of this suckling clover occurred in samples from the Hawke's Bay and Poverty Bay districts, a few samples carrying a high percentage. In certain lines of white clover dressed out of certified rye-grass a fairly high percentage of suckling is unavoidable, but purchasers should satisfy themselves that they are not paying certified white clover prices for annual suckling clover or cluster clover (*Trifolium glomeratum*).

In Table 10 is given the frequency of occurrence of the main seed impurities occurring in New Zealand machine-dressed white clover—certified old pasture. It is of interest to note that the "indicator" species for New Zealand white clover—*Anagallis arvensis* and *Silene gallica*—show reduced frequency values of 13 and 10 respectively on the figures given for "New Zealand Wild White" in Table 9 of the Station report for 1928 (*Journal* for May, 1929, page 329). The frequency values for the same two impurities for New Zealand seed—uncertified—are 41 and 23 respectively.

Clover dodder (*Cuscuta epithymum*) was noted only in 1 per cent. of all the samples examined and did not occur in either imported or New Zealand certified samples.

Red Clover.—No variations from the normal averages are shown for red clover (which also includes samples labelled "cow-grass"). Ninety-eight samples were examined for the purposes of the Canadian Seeds Act, 1923, with the results as shown in Table 6. Two samples failed to comply with the required minimum standards. These grade figures, as entered on the certificates and herein published, are for general information only, and are not to be taken as official for the purposes of the Act referred to.

Table 10.—Average Percentage of Germination and Seed Impurities of the Main Clovers according to Origin, and of Related Species, 1930.

Seed.	Average Percentage of Germination.		Percentage of Samples germinating in Groups—			Average Percentage of Seed Impurities.		Average Percentage of Hard Seeds.
	1930.	1929.	Below 80.	80–89.	90–100.	Crop.	Weed.	
White clover—								
All samples ..	83	85	30	30	40	3·6	0·8	12·0
Certified seed ..	83	82	34	31	35	4·4	0·7	13·7
New Zealand uncertified	83	86	30	31	39	3·6	0·9	12·0
Imported	78	86	59	9	32	1·6	1·9	12·7
Red clover—								
All samples ..	87	85	10	29	61	0·3	0·5	5·6
New Zealand ..	89	89	9	29	62	0·3	0·5	6·5
Imported	76	63	34	22	44	0·1	0·2	4·4
Alsike	86	82	19	30	51	2·0	0·2	5·3
Subterranean clover ..	76	73	62	35	3	0·1	0·1	21·6
Strawberry clover ..	82	74	..	20	80	0·2	0·1	17·0
Crimson clover ..	77	66	26	10	64	0·1	0·1	..
Suckling clover ..	51	65	86	11	3	13·0	5·2	33·0
Lucerne	82	78	54	28	18	0·5	0·2	11·1
Trefoil	86	86	15	19	66	0·1	0·2	2·1
Lotus major	65	66	92	8	..	12·3	0·7	12·4
Lotus hispidus ..	47	55	100	..	..	29·4	0·8	30·1

Table 11.—Relative Frequency of Occurrence of the Main Weed Impurities of 1930 New Zealand Certified "Old Pasture" White Clover.

The figures signify the number of samples in each 100 examined which contained the individual impurity.

Impurity Species.	Frequency.	Impurity Species.	Frequency.
Rumex acetosella	70	Geranium pusillim (Hawke's Bay)	13
Plantago lanceolata ..	68	Anthoxanthum odoratum ..	13
Cerastium vulgatum ..	35	Sisymbrium officinale ..	12
Chenopodium album ..	31	Trifolium arvense (Canterbury)	12
Anagallis arvensis ..	25	Silene noctiflora (Hawke's Bay)	12
Trifolium glomeratum (Hawke's Bay)	19	Spergula arvensis ..	10
Sherardia arvensis	19	Rumex crispus	9
Silene gallica	15		
Stellaria media	13		

NOTE.—"Hawke's Bay" or "Canterbury" in parentheses signifies that the species occurs exclusively in seed grown in that district.

Lotus major.—Most of the New-Zealand-grown Lotus major still shows a high percentage of Lotus hispidus, and in consequence the bulk of the pure lines on the market are imported lots. It is understood also that Australian merchants have purchased their requirements from Germany in preference to local seed for the reasons already given. It would seem reasonable to suppose that the sowing-down and production of reasonably pure Lotus major would prove profitable in New Zealand.

Other Clovers.—The average germination percentages of other clover-seeds, &c., not given in Table 10 are as follows :—

	Per Cent.		Per Cent.
Lotus corniculatus	.. 27	Hard seeds,	2
Bokhara clover (*Melilotus alba*)	.. 83	,,	9
Cluster clover	.. 56	,,	34
Alsike and white (mixed) ..	.. 80	,,	17

Root and Cruciferous Forages.

The average germination percentages of these seeds are given in Table 12. There is little to call for comment.

Table 12.—Average Germination Percentages of Roots and Cruciferous Forages.

Seed.	Percentage of Germination.				Percentage of 1930 Samples germinating in Groups—				
	Average.		Max.	Min.					
	1930.	1929.	1930.	1930.	Below 60.	60–69.	70–79.	80–89.	90–100.
Swede	84	80	100	2	6	10	14	24	46
Turnip	89	86	100	4	3	2	8	23	64
Rape	93	89	99	83	..	2	5	19	74
Kale*	80	81	98	20	2	8	20	30	34
Mangel	64	68	90	14	31	34	29	6	..
Carrot†	66	63	94	15	30	19	21	20	10

* Includes chou moellier. † Garden and field varieties.

Cereals, Vegetables, etc.

The average percentage of germinations of cereals, vegetables, &c., seeds are shown under the various headings as follows :—

Cereals, &c.

	Per Cent.		Per Cent.		Per Cent.
Oats ..	.. 85	Rye-corn ..	.. 85	Flax (*Linum*)	.. 95
Wheat ..	.. 95	Tares ..	.. 94	Blue lupin (*Lupinus angustifolia*)	.. 69
Barley ..	.. 90	Japanese millet	.. 96		

Vegetables.

	Per Cent.		Per Cent.		Per Cent.
Asparagus	.. 77	Cress ..	.. 98	Parsley ..	.. 75
Beet ..	.. 62	Cucumber	.. 85	Pumpkin ..	.. 86
Broccoli ..	.. 84	Lettuce ..	.. 92	Parsnip ..	.. 72
Beans ..	.. 95	Leek ..	.. 81	Radish ..	.. 77
Cabbage ..	.. 82	Marrow ..	.. 74	Rhubarb ..	.. 59
Carrot ..	.. 68	Melon ..	.. 62	Spinach ..	.. 75
Cauliflower	.. 70	Onion ..	.. 77	Squash ..	.. 83
Celery ..	.. 86	Peas ..	.. 92	Tomato ..	.. 83

Flowers.

	Per Cent.
Sweet peas	.. 72

Incidence of Ergot Sclerotia (Claviceps purpurea).

The occurrence of ergot sclerotia or ergot "sticks" in New-Zealand-grown grass-seeds has lately given rise to some discussion as to whether the presence of this impurity is decidedly detrimental to the pasture sown from seed containing it, or whether its presence in small quantities is of no particular moment. In this connection the following statement of Dr. G. H. Cunningham, Mycologist, Plant Research Station, is of interest: "As the disease is general throughout New Zealand, and as ergot poisoning is so rare as to be negligible, it is evident that there is little damage incurred through the use in any one locality of seed from another locality known to be infected with this fungus."

Table 13 gives the rates and percentages of occurrence of ergot sclerotia in the main grasses and clovers (ex grass-seed). That ergot is general throughout the Dominion is very evident, as is also the fact that the chances of purchasing rye-grass entirely free from it are decidedly small. The high frequency of occurrence of ergot in certified rye-grass may possibly be explained by the fact that last year all the certified seed was produced in the Hawke's Bay and Poverty Bay districts, and subsequent to the time of flowering an unusually wet season was experienced. It has been observed that the occurrence of ergot in rye-grass varies in frequency and quantity from season to season, and that a wet season in the producing districts is followed by a high rate of ergot infection.

A small percentage of ergot in grass-seed does not concern New Zealand purchasers to any great extent, but its presence has a particular significance when seed is exported. Under the Australian Federal Quarantine Act regulations seed containing ergot sclerotia is not permitted entry into that country, and, although it is probable that the regulations are not rigidly enforced, difficulties frequently occur when

Table 13.—Average Percentage and Frequency of Occurrence of Ergot Sclerotia (Claviceps purpurea) in Machine-dressed Samples, 1930.

Seed.	Total Number of Samples examined.	Samples containing Ergot.		Percentage of Total Samples* containing more than 0·1 per Cent.	Maximum Percentage of Ergot Content.	Average Percentage of Ergot Content.
		Number.	Percentage.			
Perennial rye-grass ..	300	185	61	38	1·6	0·11
Certified perennial rye-grass	119	113	95	90	3·5	0·40
Italian and Western Wolths	80	13	16	10	3·0	0·04
Cocksfoot	156	63	40	14	2·0	0·19
Crested dogstail ..	659	197	30	7	2·3	0·02
Chewings fescue ..	203	188	19	13	1·7	0·02
Brown-top	767	399	52	50	4·8	0·14
Certified brown-top ..	83	39	47	47	0·7	0·09
Timothy	54	22	41	9	0·1	0·03
Fog	27	16	59	9	0·1	0·04
Lotus spp.	33	5	15	6	0·1	0·01
Red clover	177	16	9	2	0·2	0·01
White clover ..	318	33	7	3	0·2	0·02

* Percentage of all samples examined.

even slightly infected seed is being exported to Australia. As trade in New Zealand seed is desired by both Australia and New Zealand, and as New Zealand seed, particularly rye-grass, is rarely entirely free from ergot, and furthermore as competent authorities consider poisoning of stock unlikely, it would appear to be in the best interests of the seed trade between this country and Australia if the Australian authorities would permit the entry of seed containing a certain maximum percentage of sclerotia, or, better still, a certain maximum number of sclerotia per pound of seed.

Table 14.—New Zealand Exports and Imports of Grass and Clover Seeds, 1927 to 1930.

(Compiled from returns supplied by the Customs Department.)

Seed.	1927.	1928.	1929.	1930.	
				Quantity.	Value.
		Exports.			
	Cwt.	Cwt.	Cwt.	Cwt.	£
Red clover	9,628	1,495	994	2,393	9,531
White clover	2,388	835	1,302	1,920	15,242
Other clovers	928	350	687	784	3,086
Total clovers	12,944	2,680	2,983	5,097	27,859
Brown-top	301	1,131	3,473	4,697	30,773
Chewings fescue	17,418	17,124	16,888	12,806	66,256
Crested dogstail	5,434	4,844	4,500	4,656	9,070
Rye-grass	50,162	20,581	25,915	5,954	18,507
Cocksfoot	†	496	1,183	669	4,081
Other grasses	4,489	3,382	3,116	2,681	9,691
Total grasses	77,804	47,558	55,075	31,463	138,378
Grand total (cwt.)	90,748	50,238	58,058	36,560	..
Total value	£257,136	£161,456	£182,537	..	£166,237
		Imports.			
Red clover	*	762	1,288	712	2,871
White clover	*	1,748	1,258	345	1,686
Alsike	*	2,806	1,417	2,040	7,934
Other clovers	*	1,497	751	1,005	6,339
Total clovers	2,657	6,813	4,714	4,102	18,830
Cocksfoot	5,619	9,145	4,199	230	843
Lucerne	527	17	50	294	998
Paspalum	1,940	3,026	2,615	1,350	7,714
Rye-grass	69	20	855	201	1,130
Timothy	2,905	4,765	2,843	4,347	6,100
Poa pratensis	†	51	248	2,351	4,775
Other grasses	1,741	1,839	1,332	444	2,017
Total grasses	12,801	18,863	12,142	9,217	23,577
Grand total (cwt.)	15,458	25,676	16,856	13,319	..
Total value	..	£101,373	£78,418	..	£42,407

* Not available. † Included in "other grasses."

NOTE.—The export figures do not include imported seed which has been re-exported.

EXPORTS AND IMPORTS OF GRASS AND CLOVER SEEDS, 1930.

Table 14 shows the quantities and value of the various seeds exported and imported for the year 1930, the quantities for 1927, 1928, and 1929 being also shown for comparison.

Exports.—Marked increases occurred only in brown-top and red clover. The increase in the latter would be accounted for by the Canadian demand in October and November last, when 75 tons was shipped. The export of brown-top has now passed the 200-ton mark, and increased over the 1929 shipments by 60 tons. Marked reductions were shown for Chewings fescue and rye-grass. The fescue crop last year was not a heavy one; although stocks were cleared the total exported fell by 200 tons. The export of rye-grass was the lowest for many years, there being a fall of over 1,000 tons. The crop was short, and the bulk of it was disposed of locally at good prices. The total export of seeds for 1930 showed a reduction of 1,075 tons, or 37 per cent., on that for 1929.

Imports.—Marked increases are shown for lucerne (2 tons in 1929 to 15 tons in 1930), timothy (142 to 217 tons), and Poa pratensis (12 to 117 tons). The importation of Poa pratensis was the highest for many years past. The reduction in the importation of cocksfoot is the most notable feature. During the past five years the average annual importation was 450 tons, while for 1930 the total quantity imported was only 12 tons. The import of 67 tons of paspalum represents half the quantity for 1929. Red and white clovers also show a reduction, while the unusually high importation of 42 tons of rye-grass for 1929 fell to 10 tons in 1930. The total importation figures show a reduction of 177 tons, or 20 per cent., on the quantity for the previous year.

The assistance of Mr. J. Watt, of the Seed-station staff, in preparing the tabular matter of this report is cordially acknowledged.

EFFECT OF CLEANING ON HATCHING-QUALITY OF EGGS.

H. A. KITTO, Overseer, Wallaceville Poultry Station.

THE question as to whether the cleaning of soiled or dirty eggs with a damp cloth injures their hatching-qualities is a debatable one among poultry-keepers. In an endeavour to throw some light on this matter an experiment was recently conducted at the Wallaceville Poultry Station with two lots of eggs, the first cleaned by means of a damp cloth, and the others left in the condition as taken from the nest, excepting that any thick dirt adhering was scraped off with a knife.

Two hundred and eighty-eight cleaned eggs were placed on two incubator trays, while a similar number not cleaned were placed on two other trays. These trays were placed in an incubator, the cleaned and uncleaned lots alternating. Two tested thermometers were used, one on the cleaned eggs and the other on the uncleaned. The incubator was managed in all respects according to the usual practice of this Station. None of the eggs were more than four days old when set.

The eggs were turned twice daily after the third day, and at each turning the position of the trays in the incubator was changed. The eggs were tested on the seventh day of incubation, when seventy-eight of the cleaned eggs and forty-three of the uncleaned were removed from the incubator. Of the cleaned lot forty-three contained dead germs and thirty-five proved infertile, while of the uncleaned fifteen contained dead germs and twenty-eight were infertile. When testing some of the eggs during the various stages of the incubation process the germ in the uncleaned eggs generally appeared to be stronger than those contained in the cleaned lot.

During the first week both thermometers registered an even degree of temperature—namely, 102° F.—but from then onward to the pipping stage it was observed that the temperatures registered varied slightly. The thermometer on the cleaned eggs showed a lower reading of about half a degree and this quite irrespective of the position of the trays in the incubator.

The second test was made on the fourteenth day, when twelve of the cleaned and five of the uncleaned eggs were found to contain dead germs and were removed from the incubator.

In most cases the air-cell in the uncleaned eggs dried down to a more desirable line than was the case in the cleaned eggs, while the chicks contained in the latter took from ten to twelve hours longer to hatch out. The uncleaned eggs commenced to pip on the twentieth day, while the cleaned ones showed no signs of pipping until well into the twenty-first day. The incubator was opened on the twenty-third day, when it was disclosed that 106 of the cleaned eggs had failed to hatch, as against sixty-two of the uncleaned. Eight deformed chicks were produced from the cleaned eggs, but none from those uncleaned.

This one experiment does not warrant the expression of a definite opinion regarding the particular way or ways in which cleaning of the eggs with a damp cloth had the undesirable effect on their hatching qualities; this also applies to the failure of the air-cell in the cleaned eggs to dry down to the desired line. The experiment, however, clearly indicates that better results can be secured from uncleaned eggs when subjected to artificial incubation than from eggs cleaned by means of a damp cloth. It is intended to repeat the experiment in due course.

Home-made Leather from Cow-hide.—Mr. H. Cleland, Inspector of Stock, Wanganui, mentions seeing a good sample of home-made white leather at a farm in his district from which the farmer was making his own bridles, reins, poll-straps, &c. The cow-hide was cured by the following process: Take one full bucket of burnt lime mixed with enough water to cover hide in a barrel or large milk-can. Soak hide for ten days, turning frequently; then take out, spread on floor (concrete for preference), hair side up, and scrape off hair. After taking off all hair, soak for two days in a bucketful of bran with water to cover; this will clean up the hide. Next soak for ten days in a solution of 10 lb. salt, 10 lb. ground alum, and 1 oz. oxalic acid, mixing the materials together with sufficient water to cover, and turning the hide frequently. Then tack hide on wall and stretch it as tight as possible. When dry it is fit to use.

RURAL LAND-UTILIZATION IN NEW ZEALAND.*

E. J. FAWCETT, Farm Economist, Department of Agriculture.

Introduction.

BEFORE entering upon a discussion of the present position it will be advisable to give a very brief outline of some features of historical importance in the development of land-settlement in New Zealand. The history of our colonization covers a period of little more than one hundred years. The first attempt at organized land-settlement was made by a company formed in England under the auspices of the Earl of Durham, and in 1825 two vessels arrived, the company acquiring land at Heard's Point, Hokianga, and at the mouth of the River Thames. The undertaking resulted in failure, and the company's rights were purchased by the New Zealand Company in 1839. This latter company was formed in 1838, and Colonel Wakefield, its chief agent, arrived at Port Nicholson in the ship "Tory" in 1839. The first body of immigrants arrived at the same port in 1840, their advent marking the real date from which colonization actively commenced.

Between 1840 and 1850 a number of settlements sprang up, the latter date being one of considerable importance, in that Canterbury was occupied by what was considered a moneyed class, employing labour to work the land. In that year, also, the New Zealand Company failed, and all its assets reverted to the Crown. This had an important bearing on land-settlement, as the Governor, Sir George Grey, issued regulations in 1853 reducing the price of all Crown lands by approximately 50 per cent., the prices ranging from £1 to 5s. per acre. This affected the sales of land held by companies, for it is reported that considerable sales of Crown lands took place immediately following the reduction.

Naturally, land farmed at this time was open country which required practically no clearing and could be easily cropped. Statistical records for 1853 give the total area fenced as 40,000 acres, of which 15,000 acres were under crop, the remainder being mainly native-grass country. There must have been a large area of unfenced land grazed by stock, as 35,000 head of cattle and 300,000 sheep were recorded in that year. The European population was then 27,633.

The next important landmark in development was the discovery of gold in Westland in 1863. A rush took place in 1864, and in 1866 Westland had a population of 50,000 people. Although the rural population was not immediately affected, this influx of fortune-seekers had a stimulating effect on the pastoral and agricultural industries.

From 1853 to 1881 development of land went steadily forward. It was not until about 1870 that forest land in any quantity began to be cleared for farming purposes. During this period New Zealand agriculture relied for its existence on local consumption of meat, butter, and milk, upon the export of wool and tallow to England, and of small quantities of salted meats and butter to Australia. The statistics of importance during these years are given in Table 1 (next page).

We come now to the most momentous undertaking in the history of our rural development—namely, the commencement of meat transport under refrigeration. A severe depression in prices set in about 1878, and pastoralists were facing a crisis by 1880. The production of meat, &c., had developed beyond local requirements, and the prices received were extremely low. Surplus stock was boiled down for tallow. The export

* Substance of a paper delivered to the Wellington branch of the Institute of Pacific Relations in 1930.

Table 1.

	1861.	1871.	1881.
Population (whites)	99,021	256,393	489,933
Sheep	2,760,183	9,700,629	12,985,085
Cattle	193,150	436,592	698,637
Horses	28,275	81,028	161,736
Area in grass or under cultivation (acres)	226,600	1,226,222	5,200,000

trade of the colony was not great enough to meet its trading requirements. Low wool prices and several bad harvests completed the depression.

As far back as 1843 Thomas Sutcliffe Mort, a Lancashireman living in Australia, turned his attention to the freezing of meat for export. The first meat-freezing works in the world were established by him at Darling Harbour, Sydney, in 1861. He attempted a shipment in 1876, which was a failure. The first successful shipment of frozen meat was made in 1877, when 80 tons was shipped from South America to France and arrived in perfect condition. The experiments being undertaken in different countries were closely watched by New Zealand meat interests, and when Australia made a successful trial shipment in 1880 Mr. W. S. Davidson, of Edinburgh, Manager of the New Zealand and Australian Land Co., considered it time to attempt a shipment from New Zealand. The sailing-ship "Dunedin," of 1,200 tons, was fitted up for the project, the organization at this end being in the hands of Mr. T. Brydone. Freezing commenced on 7th December, 1881, the carcasses being put straight into the ship's freezing-chamber. After sundry mishaps loading was completed, and the ship sailed in February, 1882, arriving in London in May. The experiment was entirely successful, and thus the foundation of our present prosperity was laid and a new era commenced, for without commercial refrigeration the land of New Zealand would never have been developed as it has been. Ten years later 2,000,000 carcasses, or approximately 1,000,000 cwt., were exported in one year, and many people thought that must be the limit. During the 1929–30 season we exported 3,000,000 cwt. of lamb and mutton.

Following the inauguration of the meat-export trade, great activity was to be expected. Freezing-works began to spring up in various localities. It was rapidly realized that if meat could be exported so also could butter and cheese. In 1882 the Government offered a bonus of £500 for the first 50 tons of cheese produced by a co-operative factory. Thus our other great industry was launched, butter and cheese factories on a co-operative basis being erected at a rate which resulted in ten years in a total of fifty-five cheese-factories, sixty-two butter-factories, sixty creameries, and two condensing factories being completed, with thirty-five new factories of all kinds in course of erection.

An era of recoupment and comparative prosperity had now set in. As an indication of this, it is interesting to note that the years 1879 to 1883 inclusive averaged 1,544 bankruptcies per year, but after that date the number gradually declined, reaching the lowest point in 1919 and 1920. There have been no phenomenal movements since, but the upward trend in production has been steady and sustained. Population has steadily increased, thus providing a local market for a large proportion of primary products.

The area of land brought into occupation steadily increased up to 1918–19, since when it has been comparatively steady, ranging from 43·2 to 43·65 million acres. With improved prices for meat, and the steady development of dairying on better-class lands, a rapid deforestation took place, some 12·5 million acres being felled, burned, and grassed between the years 1870

and 1922. It was rapidly realized that the future of New Zealand's agriculture depended on live-stock products, and with the expansion of the sheep and dairy industries grain-growing gradually assumed less importance, until to-day we barely supply local requirements, a great proportion of the cultivation being for the supply of stock-foods.

Right up till the end of the war, in 1918, we depended mainly on natural fertility of the soil—especially on the stored-up fertility of centuries represented by the native forests—for increase in production. This was supplemented by cropping, especially in the form of turnips, swedes, and rape. With the realization of the importance of grass-utilization some interesting developments in stock-management were gradually taking place. In the early years of meat-export mature sheep represented the major proportion of our trade. It was soon appreciated that in order to utilize natural grass growth to the maximum, the highest possible proportion of our stock must be breeding animals, and that output must be in the form of young animals which could be grown and fattened on the spring flush of grass. Greater attention was therefore paid to increasing the ewe flocks.

In 1910–12 total sheep numbered 20·3 millions, of which 9·6 millions were ewes. In 1921–22 the figures were 22·2 millions and 12·1 millions respectively. The last enumeration, in April, 1930, was 30·8 millions and 17·5 millions, showing the remarkable increase in that class of animal capable of providing an avenue of consumption of increased summer feed. Killings of lambs gradually overtook those of mature sheep, and for some time past have largely exceeded the latter. This movement represents a most important aspect in our present system of land-utilization, and has been further developed in the growth of the dairying industry. In 1895—the first record we have of the classification of cattle into dairy and station stock—dairy cows numbered 257,140. By 1911 the number had increased to 633,733; in 1920 to 893,454; and for 1930 the figure stands at 1,440,321.

The great development of the dairy industry has been made possible by a number of factors which have facilitated its adoption in districts which at the commencement were badly served with road access. The manufacture of cheese was for some years restricted to certain districts having good roads, as where a large bulk of milk had to be transported such roads were an essential. The introduction of home separation of cream placed an entirely different complexion on the industry, enabling farmers in isolated districts to undertake milking for butter-factory supply. In 1919–20 there were 26,678 separators in use on farms, and the number has increased to 48,302 in 1929–30. The widespread use of milking-machines has revolutionized labour problems, the number of plants increasing from 8,806 in 1919–20 to 20,415 in 1929–30. Additional improvements in milking conditions, such as concrete yards, walk-through sheds instead of the back-out type, &c., have contributed to the removal of the old-time prejudice against milking as a means of livelihood.

Another contributory factor in the production of all classes of live-stock products is to be found in mechanical road transport, which has enabled rapid collection to be undertaken with a consequent improvement in quality of products. Mechanical transport has, on the other hand, been responsible for the reduction in the area devoted to oats for horse-feed. In 1911 there were 404,284 horses in New Zealand, while in 1930 the number has been reduced to 297,195.

During the war period, 1914–15 to 1918–19, development was retarded owing to scarcity of labour, and undoubtedly a considerable amount of deterioration took place on certain classes of land. The repatriation of troops, the demand for land occasioned by soldier settlement, and the inflation of land-values immediately following, created a state of unrest which did not help the position. Extensive dealings in land, immediately followed by the slump of 1919–20, further delayed organization. Sheep

flocks were rapidly depleted, the heavy killings which took place actually representing a realization on capital. Recovery commenced during the season 1922–23, the position being improved each year up to 1930. Fortunately, the development in dairying was maintained during the slump period.

We now come to the most recent and perhaps the most significant development of farming practice in the history of our land-utilization. At the beginning of the present decade it became apparent that the remaining native forest land was in most instances unsuitable for pasture; in fact, it was realized that much of the bush which had been ruthlessly felled in the past should still be covering the unsightly and practically worthless hilltops. Thus it was necessary to maintain the fertility of as much of the existing grassland as possible. As practically the whole of the unoccupied or unproductive land was decidedly submarginal in the economic sense, it was imperative that greater production should be secured from our improved holdings. Years of depletion and export of fertility through the medium of millions of carcasses of stock and higher quantities of butterfat began to tell its tale. The war had one important bearing on the future of New Zealand. The island of Nauru, a German possession of tremendous potential wealth in mineral phosphates, fell into the hands of the British. Being comparatively close to Australia and New Zealand, we have been able to procure from this source (including also Ocean Island) large quantities of rock phosphate, and this supply has had a great bearing on our increased production during the last decade.

Although artificial fertilizers had been used previously, this was mainly for cropping-purposes, and it was not until after the war that a Dominion-wide recognition of the use of fertilizers as a top-dressing for pasture was secured. The climate of the North Island is particularly suitable for pasture growth, and remarkable results were rapidly derived from the practice of top-dressing. Thus in the last few years New Zealand has become recognized as perhaps the finest example of the possibilities of pasture-utilization in the world. But we still have a long way to go. Up to the present it has been better-class pasture land which has been treated, especially that devoted to dairying. Records of fertilizer used and area top-dressed are available for four seasons only, the figures being as follows:—

Table 2.

Season.	Approximate Area.	Fertilizer.
	Acres.	Tons.
1926–27	1,414,264	179,748
1927–28	1,834,366	237,602
1928–29	2,534,496	307,897
1929–30	2,650,748	335,276

In addition to the practice of top-dressing, a great amount of work has been done to illustrate the advantages of subdivision of paddocks and rotational grazing of pastures. It is due to systematic use of fertilizers and to fuller utilization of available grass-growth that we have been enabled of recent years to increase our live-stock by at least 3,000,000 sheep and a quarter of a million dairy cows on practically the same area of land.

Occupied Land and Methods of Utilization.

It is now necessary to give in some detail the area of land occupied and methods of utilization, showing the distribution of different classes of stock and crops. The figures for crops apply to the year 1929.

The total area of New Zealand, including adjacent islands, is 66,390,262 acres, of which the North Island represents 28,243,840 and the South Island 37,196,800 acres. The portion now to be discussed is that area which is occupied—namely, 43,522,131 acres—of which 18,708,408 are in the North and 24,813,723 in the South Island. A considerable area of occupied land in both Islands is unproductive at the present time, being in virgin bush, fern, scrub, and second growth, or definitely barren. According to the Government Statistician's enumeration, the occupied unproductive area is made up as follows:—

	Acres.
Virgin bush	3,883,805
Fern, scrub, and second growth	4,016,774
Barren and unproductive	2,309,117
Flax (Phormium)	62,704
Total	10,272,400

Of this amount, 4,820,167 acres are in the North and 5,452,233 acres in the South Island. The area devoted to flax is not truly unproductive, but it is in a class distinct from agricultural land. It is not necessary to discuss this area of unproductive land at present, but it will be touched upon at a later stage.

The remaining area in active utilization totals 33,249,731 acres, and is made up of sown grasses, native and tussock grassland, land cultivated for cash crops and for supplementary stock-food, and of orchards, tree-plantations, and private gardens. Of the total area of 19,118,101 acres in sown grasses or under cultivation approximately two-thirds are in the North Island, as in the native state the greatest proportion of its obviously good land was under forest, while the South Island had large tracts of grazing land requiring no great expenditure to bring it into utilization. The present position is as under:—

Table 3.

—	Total area in Sown Grasses and under Cultivation.	Native Grass and Tussock.	Total Productive.
	Acres.	Acres.	Acres.
North Island	12,564,020	1,324,221	13,888,241
South Island	6,554,081	12,807,409	19,361,490
Totals	19,118,101	14,131,630	33,249,731

Land under sown grasses or being cultivated is known as improved, whilst native grass and tussock areas are termed unimproved country. Of the former, 1,357,884 acres are under the plough, whilst 516,389 acres are in orchards, gardens, and plantations.

Although practically the whole of our exports are live-stock products, cropping occupies an important place in land-utilization in certain parts of the country. There are a number of small industries which also might be mentioned, but which do not represent any great land-usage. Honey and egg production are typical instances. We can now proceed to consider in some detail those activities which account for land-utilization.

Arable Cropping.

Cash Crops.

Wheat.—The total area devoted to wheat in the 1928–29 season was 255,312 acres, giving a total yield of 8,832,864 bushels. Between six and seven million bushels are required annually for flour, &c., and from two

to three million bushels for stock-food. The area given above is an average season's sowing, but of recent years heavy yields have been secured. The wheat industry is protected by a sliding scale of duty, the contention being that it is nationally essential to grow our own requirements in case of world shortage or blockade, and that without protection New Zealand farmers cannot grow wheat at a reasonable profit. In 1929 an attempt was made to clear some of the accumulated stocks by exporting about 220,000 bushels. Wheat has not figured as an exportable commodity for many years past. In fact, we import considerable quantities annually, either in the form of flour or whole wheat, the object being to mix a harder wheat with locally produced to improve flour-texture. During 1928, 456,633 centals of wheat and 189,901 centals of flour were imported, while the figures for 1929 were 152,695 and 195,418 centals respectively. Wheat is grown mainly in districts having a low rainfall with definite dry harvest periods. Canterbury was responsible for 212,098 out of the total 255,312 acres, and Otago contributed 29,207 acres. Small areas were grown in all the other land districts, but the North Island climate is not suitable in an average season. There is no likelihood of the area sown in wheat materially increasing. The reverse is more likely to apply, particularly if the present agitation for the removal of duties is successful.

Oats.—Oats represent the next most important cash crop, an area of 194,638 acres being sown for chaff and 73,101 acres for threshing purposes. The total yield was 333,220 tons of chaff and 3,065,113 bushels of grain. Again we find a small export slightly larger than imports. The area under oats for chaff and grain is likely to fall in sympathy with replacement of horses by mechanical power. Canterbury is again the largest growing centre, but considerable areas are planted in Otago and Southland. The North Island relies almost entirely on Southern supplies for its needs. Of the total 267,739 acres, Canterbury represents 132,719 acres, Otago 53,993 acres and Southland 47,171 acres. The remainder is distributed over the remaining districts, with Marlborough as the next largest-growing centre.

Barley.—There is sufficient barley grown to meet local malting demands, the total area being 19,500 acres in the season 1928–29, giving a yield of 781,102 bushels. Of this area Canterbury contributed 9,561, Otago 3,819, and Marlborough 3,415 acres.

Peas.—This crop is of considerable importance in Canterbury and Marlborough, for, although the total area grown is only 17,893 acres, yielding 527,504 bushels, a considerable proportion is exported. The export figures for 1928 and 1929 were 220,954 and 173,792 centals respectively. There is a steady demand for New Zealand seed-peas, and under strict certification this trade can be increased. Canterbury grew 10,827 and Marlborough 4,945 out of the total 17,893 acres.

Other Grain and Pulse Crops, &c.—There are a number of crops grown in small areas. Maize represents 8,986 acres, mainly in Auckland and Gisborne Land Districts; linseed 2,800 acres, mainly in Canterbury; and hops 809 acres, practically wholly in Nelson. They do not represent a large area, but fit in well with the conditions of farming met with in the several localities.

Potatoes.—The area planted in potatoes each year varies round 20,000 acres, the actual area for 1928–29 being 21,304 acres, yielding 123,607 tons. Export is restricted, and there is a practical embargo against imports, disease being the reason of restriction in both cases. We therefore must grow sufficient to meet local requirements. Canterbury again leads with 12,888 acres; Otago grows 1,689 acres, North Auckland 1,599, Wellington 1,564, and Southland 1,096 acres. All the other land districts grow a small quantity, but Canterbury is the great source of supply. Early potatoes catering for a special trade are grown mainly in Auckland and North

Auckland. The demand for potatoes is inelastic, and any acute variation in area cannot be expected. It is an expensive crop to grow, and an increase in production would seriously affect the present economic position.

Onions.—The total area under this crop was 880 acres, Canterbury growing 653 and North Auckland 147 acres. The total area produced 10,655 tons of onions, of which 2,622 tons were exported, but in the same year 2,901 tons were imported. The difficulty with this crop is the inability to store onions for any length of time, and consequently trading is essential. The area grown has remained comparatively stationary for a great number of years.

Fed-off Crops.

Fed-off crops are in an entirely different category. Large areas are grown for supplementary stock-food, particularly in those districts where mixed farming is practised. This applies specially to the South Island, where sheep are run in conjunction with cropping, and, as a short rotation is the keynote of farm-management, cropping plays an integral part in the replacement of pastures.

Green Fodder.—The term green fodder embraces rape, green oats, and other cereals specially used for the fattening of lambs and store sheep. The total area grown in 1928–29 was 219,088 acres, and the fact that Canterbury accounted for 103,051 acres of this total indicates the importance of supplementary feed in sheep-farming activities of that district. Otago contributed 36,429 acres, Southland 25,135, Wellington 15,769, and Hawke's Bay 13,742 acres. The remainder is scattered over each of the land districts. This class of crop is likely to decrease as top-dressing plays a more important part in pasture maintenance on sheep-farms.

Turnips.—Turnips are used mainly as an autumn and winter crop, the object being to assist in carrying young sheep and ewes through the winter. This particularly applies on farms where, owing to a large proportion being under grain crops, the area of grass is restricted, and without supplementary feed winter carrying-capacity would be low. Turnips are also most valuable where, owing to low winter temperatures, grass-growth is dormant. The South Island is the chief grower of this crop. Of a total of 479,994 acres, Canterbury represents 140,710, Otago 101,061, and Southland 113,559 acres. In the North Island Wellington grew 33,058 acres, Auckland 38,192, Taranaki 19,711, Hawke's Bay 11,467, and North Auckland 7,655 acres. In the North Island turnips have been used extensively as a winter feed for dairy cows in the past, but this practice is gradually giving way to the use of ensilage, hay, and grass specially saved for the purpose, and made possible through the use of fertilizers.

Mangels.—Mangels are grown in small quantities in most districts, being used mainly for dairy cows. The total area was 9,914 acres, spread over the Dominion, Canterbury leading with 2,830 acres, and Wellington following with 2,184 acres.

Importance of South Island in Arable Cropping.

From the foregoing discussion of those crops comprising the 1,357,884 acres under the plough, it will be realized that the South Island, notably the Land District of Canterbury, plays a very important part in producton of certain commodities essential for the food-supply of the whole Dominion. In addition to human food-supply, this district is the source of practically the whole grain and chaff requirements for the maintenance of horses, poultry, and pigs, and therefore contributes indirectly to production of exportable commodities to a greater extent than the area would indicate.

Fruit-growing.

Commercial orchards are somewhat scattered, but there are five clearly defined districts where this industry is carried on under fairly satisfactory conditions—namely, North Auckland, Hawke's Bay, Nelson, Canterbury, and Otago. The areas in commercial-producing orchards in these districts are 3,687, 2,221, 4,989, 1,569, and 3,274 acres respectively. Thus these five districts account for 15,740 of the total 17,705 acres in commercial-bearing orchards. In addition there are 1,514 acres of young trees mainly in the districts mentioned, and also 5,319 acres of orchards for private use. The latter are evenly distributed, representing home orchards only. Other conditions being equal, quality of the soil is of importance in fruit-farming as in other branches of our primary industries. Quite a healthy export trade is being built up in apples, the total quantity shipped for 1930 being approximately one and a quarter million cases. The industry has decided possibilities as soon as marketing organization is perfected, even the local market presenting great scope for increased consumption.

Live-stock Farming.

We now come to the major source of the Dominion's wealth—namely, those two great live-stock industries, sheep and dairy farming. Although in addition to sheep and dairy cows we have station cattle and pigs, these are supplementary to the two major issues, and must be treated in conjunction with one or the other.

The Sheep Industry.

Up to the present time the sheep has held pride of place in the development of New Zealand. Our national economic history is bound up with the history of the building-up of an export trade in meat and wool. To-day sheep-farming represents a highly specialized profession, necessitating as it does the employment of sound business principles, ability to interpret and apply the results of research, as well as keen judgment in the practical application of breeding-principles. To ensure success in its highest degree every farmer must be his own research officer working in the laboratory represented by his farm, and applying in his management those principles which best suit his particular condition. The day is gone when it was considered that anybody could become a successful farmer, and these observations apply to all rural activities, whether it be sheep-farming, dairying, or cropping. Success depends on the ability to exploit knowledge and practice, so that under prevailing conditions a living surplus remains after production costs are met.

Sheep-farming has many and varied ramifications. Sheep types vary to such an extent that they can be used to exploit a wide range of conditions, returns to the farmer varying according to the system of management possible under those conditions. It has been previously stated that over 14,000,000 acres of land occupied is of the native grass and tussock type, the major portion of which is in the South Island. This land varies greatly in carrying-capacity due to altitude and type. On the high country of the South Island it is essential that to withstand climatic conditions the most hardy breed of animal be used, so there we find low-producing merino sheep, with wool as practically the only saleable commodity. Carrying-capacity varies from one sheep to 3 acres to as low as one sheep to 7 or 8 acres. The outstanding principle of management is an endeavour to carry as high a proportion of heavy dry sheep as possible to procure the maximum amount of wool. Therefore breeding-ewes are reduced to a minimum compatible with safety to maintain stock numbers. This represents the system of sheep-farming offering the lowest per-sheep return,

but demanding expert knowledge and long practical experience to meet and overcome the difficulties met with, particularly within snow belts. Commencing at this type of sheep-farming we have a gradually ascending scale, the indicator of improvement in production being the increase in percentage of ewes to dry sheep, until we arrive at the other extreme where 100 per cent. of ewes are farmed, each year both ewes and their lambs being fattened and sold.

This latter type of sheep-farming is met with on picked land scattered throughout New Zealand, and represents a most valuable national asset. For its continuance and possible extension, a constant supply of aged ewes from hill country is essential. This system of gravitation fits in admirably with hill-country management, where we find a gradation of stocking types averaging round 50 per cent. of ewes. Where the ewe percentage is below 50, fat lambs are incidental in farm turnover, the major trade being in fat wethers, and store lambs and ewes. As the ewe percentage increases, so does the ability to produce fat lambs increase, ewe capacity as previously mentioned being an indicator of quality. It is from farms of the average and low type that the great bulk of old ewes come to supply fattening farms, there to spend their remaining days after their teeth have been so worn on hard country that luscious grass is essential to enable them to produce yet another lamb and to become fat themselves.

We have previously noted that in the South Island particularly, large areas of supplementary crops are grown for sheep-feed, and this, in conjunction with young and nutritious grass, comprises the feed of old ewes in the South, while in the North, grass pasture rejuvenated by top-dressing constitutes the main food-supply. The great difficulty experienced in hill country sheep-farming, which represents the major area utilized by sheep, has been the maintenance of soil-fertility. Consequent upon the gradual depletion of accumulated fertility, all our erstwhile bush country has shown signs of regression. The term deterioration is commonly used, but is likely to be misunderstood, as it is also generally accepted as covering that state where second growth of scrub has taken place. Artificial fertilizers cannot be used extensively to allay this movement, neither can cultivation in the accepted sense be practised. Therefore to meet the position to a degree compatible with management practice, heavy cattle are used in fairly large numbers. Hill cattle are at present inseparable from sheep-farming, and are run not with the expectation of great profit from their actual sale, but primarily as implements of cultivation in the maintenance of sheep-pasture, any profit from them being incidental only.

The stock-in-trade of the sheep industry in April, 1930, was as follows: Breeding-ewes, 17,564,175; other sheep, 13,277,112: total sheep, 30,841,287. Mature cattle, 863,681; young cattle, 580,000 (approx.): total cattle, 1,443,681. Of the total sheep, 16,628,259 were carried in the North Island and 14,213,028 in the South. As is to be expected when we consider the area of hill country in sown grasses farmed in the respective Islands, the North predominates in hill cattle.

The area of grassland utilized in the sheep industry comprises the whole of the native grass and tussock and an estimated area of 12,366,259 acres of sown grassland. In addition to these areas, practically the whole of the 219,088 acres of green feed and 479,994 acres of turnips represents land devoted to this industry.

The most intensive winter carrying-capacity, considering land districts as a whole, is found in Hawke's Bay, where 1·38 sheep are wintered per acre of the total land occupied. Naturally those districts having a high percentage of unimproved land show a low average capacity and thus we find the South Island varying from 0·59 to 0·039 sheep per acre. Districts specializing in dairying show low sheep-capacity also. Thus Taranaki,

Auckland, and North Auckland figures are no indication of carrying-capacity. Of those counties practically wholly devoted to sheep, Patangata, Waipukurau, and Weber lead with a wintering-capacity of 1·70, 1·67, and 1·60 sheep per acre of total occupied land. This is not a true indication of production, as wintering-capacity is not a true indicator of land-quality unless ewe percentage is known also. Thus Oroua, with 1·5 sheep wintered, may contain land of a higher production-capacity than is to be found in Patangata, as more specialized fattening farms are situated in this district.

The following tabulation of total production is based on standard values, so that the figures indicate volume of production as well as values at standard prices.

Table 4.

Commodity.	1928–29.	1929–1930.
	£	£
Mutton	3,500,000	4,050,000
Lamb	6,200,000	6,640,000
Wool	11,950,000	12,610,000
Beef	2,060,000	1,840,000
Totals	23,710,000	25,140,000

Contrary to the trend of recent years, killings of mature sheep have shown an increase. This was to be expected, as an accumulation of aged ewes kept longer than has hitherto been the practice had to be disposed of. The fact that farmers needed cash to make up in some measure for a drop in revenue due to lower prices has been a contributing cause in the heavy killings of mature sheep. The same movement was noted during the slump of 1919–20. Steadily increasing volumes of lamb products have been made possible by increased ewe flocks, and this illustrates the ability of farmers to exploit a higher priced market with a commodity, the production of which fits in with improved grassland-utilization management. It is difficult to estimate the absorptive capacity of English markets for this type of produce, and it remains to be seen whether the public can be induced to consume a still greater proportion of lamb at a price which does not materially affect the price of the whole supply.

Practically the whole of our meat exports go to Great Britain, and the figures below are therefore of interest. Beef does not represent an important export, the major proportion being consumed within New Zealand.

Table 5.—Mutton and Lamb imported by Great Britain.

Year.	Total Imports.	From New Zealand.	New Zealand Percentage of Whole.	New Zealand Total Export.
	Cwt.	Cwt.		Cwt.
1927 :	5,610,225	2,723,672	48·5	2,777,991
1928 :	5,497,187	2,825,224	51·4	2,835,167
1929 :	5,638,382	2,705,023	48·0	2,763,170

The Dairy Industry.

Although the sheep industry still maintains a lead in economic importance the increase in dairying during recent years indicates that in the near future there may be a reversal of this position. The outstanding feature during the last decade has undoubtedly been the rapid growth of production from this industry. Development has been due to the realization

that land of a natural low-fertility standard can be made to carry high-production pastures, provided rainfall is adequate and well distributed over the year. Rainfall in conjunction with a sustained temperature allows of a long period of grass-growth, and when these conditions are combined with a free root-bed for pasture plants as is the case over the greater portion of the North Island, nature has done her best to set the stage for the establishment of pastures of a type most suited to milk-production. Dairy-farmers have appreciated this fact, and have found that by supplementing nature's provision, by systematic manuring, pastures unsurpassed anywhere in the world have been their reward.

The adoption of up-to-date pasture-management methods combined with systematic breeding of dairy animals has placed the industry in its present position. The more rigorous winters of the South, combined with less kindly soil conditions, have retarded development, but even there a steady upward trend in numbers and yield has taken place. The dairying industry must, however, depend on the North Island for its rapid expansion of the future. Owing to the fact that a high-grade milking cow is an extremely sensitive animal, she cannot be subjected to hard conditions and be expected to produce her maximum. Therefore, dairying is confined to flat, undulating, and rolling country where cows do not have to forage for food, and where top-dressing can be carried out easily and quickly. Factors contributing to rapid development are: (1) The ability of an everage family to operate a dairy unit of a size which provides a reasonable living reward for labour expended. (2) On fairly high-priced land capital requirements for a family farm are not so great as in the case of a sheep-farm returning the same labour reward. (3) It is the ideal farm-type for a man with limited finances, as the system of pay-out from factories ensures a regular income from month to month.

The constant endeavour to commence lactation at an earlier date in the spring is an outstanding feature of management. It is recognized that spring and summer months are the most profitable, and bringing cows into milk early ensures that natural peak production synchronizes with peak grass-growth. Management has then tended towards an earlier commencement and a longer lactation-period, and this, together with an increased density of milking cows, has increased average production per cow and per acre. Labour-saving devices in the milking-shed are practically universal in fully developed districts. The dairy-farmer still has his worries, the chief of which is prevalence of disease in his stock. It is often contended that the foregoing trends in management are to a great extent aggravating his troubles. Undoubtedly control methods are made difficult. Disease is a big factor in the incidence of cow replacement, the average effective life of a dairy cow being in the region of six years.

The expansion of the industry in the past on to land of low natural fertility makes it impossible to accurately foretell the future, but further increases are assured. Large areas of land at present embraced in dairy-farms must be more fully exploited. At the present time per-acre production over the whole area devoted to cows is in the vicinity of 80 lb. of butterfat per acre. Many instances of 200 lb. per acre are known, and even if the average were raised to 100 lb. per acre the addition to our exportable surplus would be most welcome.

Statistical data relative to dairy cows are available as at 31st January each year, the number returned for 1930 being 1,440,321 cows in milk or dry. This does not represent the true wintering figure, as culling takes place between January and April. In addition to dairy stock, 61,706 breeding-sows were recorded, mainly on dairy-farms. In considering the pig position, sows are the only reliable guide, as killings of young stock are taking place throughout the year. Of the total dairy cows 1,181,707 were in the North, and 258,614 in the South Island. Young stock was wintered in the same proportion.

Dairying is carried out commercially in fairly clearly defined districts. The estimated total area of sown grass devoted to cows and young stock is 4,000,000 acres, of which some 320,000 acres are cut annually for hay or ensilage. The great bulk of cows are located in Auckland, North Auckland, and Taranaki Land Districts, the numbers being 421,531, 244,689, and 316,254 respectively; these three districts accounting for 982,474 cows out of the total 1,440,321. In addition to the well-known dairying centres commonly known as Taranaki and the Waikato, considerable development has taken place in North Auckland, while portions of Wellington, Hawks's Bay, and Gisborne are devoted to cows. In the South Island, centres of greatest note are Waitaki, Wallace, and Southland. Cow density varies from one cow per acre to one cow per 5 acres, great fluctuations being found in the same district. The county having highest cow density is Waimate West, in Taranaki, with 402·63 cows per 1,000 acres over the total occupied area. Piako, in the Waikato, comes next with 293·63, followed by Hauraki Plains with 265·47. Undoubtedly dairying represents the most intensive form of production possible on an extensive scale under present conditions, and its expansion must result in advantage to the State.

The estimated total production for the past season, computed on standard values, is as follows:—

Table 6.

Product.	1928–29.	1929–30.
	£	£
Dairy-products	18,070,000	19,850,000
Pig-products	1,280,000	1,380,000
Totals	19,350,000	21,230,000

As a side-line to dairy-farming, pig-raising has not been fully exploited. During the 1928–29 season, some 552,000 pigs were slaughtered for all purposes, representing 7·4 per breeding-sow. This figure is the effective breeding-capacity of sows under existing management conditions. The total export of pork, bacon, and hams in 1929 amounted to 173,094 cwt. only. Where pigs are reasonably handled on dairy-farms there is no difficulty in procuring a net return from pig-products of £2 for every cow milked. In Denmark the greater proportion of sows give two litters per year, which is the ideal to aim for if a winter supply of milk is assured. In New Zealand breeding is usually controlled to produce the largest number of fattening pigs when milk is plentiful, autumn litters kept as stores through the winter needing supplementary feed. The following figures dealing with export of dairy-produce are of interest:—

Table 7.

	1927.	1928.	1929.
Butter imported by Great Britain (cwt.) ..	5,927,602	6,083,457	6,305,799
Supplied by New Zealand (cwt.) ..	1,185,463	1,271,103	1,270,310
Percentage supplied by New Zealand ..	20	21	20
Total New Zealand export (cwt.) ..	1,455,539	1,449,570	1,566,734
Cheese imported by Great Britain (cwt.) ..	2,916,814	2,997,412	3,005,708
Supplied by New Zealand (cwt.) ..	1,554,304	1,584,383	1,790,862
Percentage supplied by New Zealand ..	53·3	52·9	59·5

Live-stock Production based on Standard Values.

In the following tabulations the whole of our live-stock production has been brought together on standard values, and gives a very clear idea of the advances made over the last ten years :—

Table 8.

Season.	Value at Standard Prices.	Average of Five Years.
	£	£
1920–21	30,910,000	
1921–22	35,470,000	
1922–23	34,320,000	34,626,000
1923–24	35,470,000	
1924–25	36,960,000	
1925–26	36,950,000	
1926–27	39,430,000	
1927–28	41,150,000	41,430,000
1928–29	43,250,000	
1929–30	46,370,000	

Table 9.

Season.	Increase over Average of previous Five Seasons.	Percentage of Increase.
	£	
1925–26	2,324,000	6·7
1926–27	4,804,000	13·9
1927–28	6,524,000	18·8
1928–29	8,624,000	24·9
1929–30	11,744,000	33·9

In these calculations no account has been taken of the increase in capital represented by increased stock numbers. If this were added, and it can quite fairly be looked upon as increased value, the position would be much more remarkable than is suggested above.

Future Developments.

We may now take a glance into the future. It is generally agreed that the products from the land are the foundation of our prosperity, although production of the raw material is but a stage in its conversion into trade channels.

As an exporting country, with monetary obligations abroad and competing on the world's markets, it is essential that we increase our exportable surplus to meet increasing obligations, or that we reduce imports by manufacturing our requirements locally, at the same time controlling our obligations. Were it possible for us to manufacture secondary goods at a price which would enable us to export in quantity, it would be a sound policy to exploit such a trade. As such an eventuality is unlikely, we must look to the land for our tradeable commodities.

It is suggested by some that the only way for farmers to realize a payable price for their goods is to reduce the world's available supply. This may be a sound business principle in a country depending entirely

on its own production for its needs, or if all countries acted in unison; but would be fatal to both the individual and the State where the products of a country represent but a comparatively small proportion of the supply on the main consuming markets. This fact is clearly illustrated in our own case. For the seasons 1920 to 1925, production remained fairly stable, the average annual live-stock production on standard values being £34,626,000. For 1929–30, using the same standard values, production reached £46,370,000, or an increase of £11,744,000. Had we only maintained the volume of the 1920–25 period, our total volume of bartering-power would have been at least £10,000,000 lower than has actually been the case.

How can we procure an increased and a cumulative increased production from year to year? The immediate limiting factor is the area of land available for the production of exportable goods. The channels which must be explored to attain our objects are—

(1) The breaking-in of land at present lying idle, but which is capable of producing to some extent under the right conditions.

(2) The subdivision of good land held in large blocks which at present is not producing to its maximum owing to (*a*) the type of farming being practised, (*b*) absence of cheap labour, (*c*) insufficient capital, (*d*) lack of the urge to obtain maximum production, which may be due to inability to organize, or where owing to an easy financial position the necessity is not acute.

(3) The subdivision and exploitation of semi-developed land at present in occupation, which requires a well-directed expenditure of new capital, and which under such conditions is capable of producing as highly as land considered first-class dairying country at the present time.

(4) The investigation of improved management methods, and the dissemination of the most economic methods of production through the medium of a vigorous instructional policy, aiming at the raising of production on those farms which at present are not producing to their maximum, but where the conditions are suitable provided the farmer has the necessary knowledge and capital to obtain increased production.

Breaking-in of Idle Land.

The total area of idle land—that is, land not producing any recognized agricultural or pastoral product—amounted in 1929 to 32,800,000 acres, or almost one-half of the total area of the Dominion. Of this amount, 10,000,000 acres are occupied, while 22,800,000 acres belong to the Crown or are held by Maoris. Twelve and a half million acres of this unproductive land is still under virgin native forest, 3,800,000 acres being privately owned, while the remaining 8,700,000 acres are held by the Crown or by Maoris. After deducting standing forest from the total unoccupied area, we find that there are 14,100,000 acres left, included in which are lakes, rivers, roads, urban areas, mountains, reserves, &c. When all these deductions are made, there are large areas of semi-cleared land available for occupation. Of the occupied unproductive land 2,300,000 acres are definitely barren and worthless. We therefore have an occupied area left of 4,000,000 acres which are in fern, scrub, and second growth, a large proportion of which represents hill country that should never have been felled. It also embraces pumice and gum land, large areas of which are of a type capable of being broken in. Thus we find that there are some 12,500,000 acres of forest land, and large areas of open country, which are not producing.

The variation in types within pumice and gum lands available for utilization is very great, much of it being unsuitable for agricultural or pastoral purposes at the present time. There still remains a large area which might be settled. The settlement of this country by individual effort

demands a considerable amount of capital, or the patience to wait for results and a great capacity for self-denial. A study of the development which has taken place up to the present must impress us with the desirability of facing this problem as a community undertaking if it is to be faced, so that settlers when they are finally placed may be able to extract a reasonable living from the commencement of private ownership. It must be recognized that much if not all of this land is submarginal under present economic conditions, and therefore cheaper methods of development must be devised, or private individuals or the State be prepared to lose development capital. If a large-enough area could be broken in and settled with a suitable type of farmer, the increased trading power represented in exportable produce might well repay the State for such an undertaking, but the possibilities are so obscure that a long-time policy is difficult of execution.

Subdivision of Good Land.

There are undoubtedly large tracts of high-class country at present held in big blocks which are not producing to their maximum. This type may be more closely settled by private subdivision or by State purchase and subdivision. Even under a graduated taxation scheme the former is slow. The newly settled occupiers, however, commence on a comparatively high-production level, and provided they have some private financial backing the State is assured of its interest and security. If some scheme can be devised whereby subdivision of this class of land is undertaken without large capital outlays of State funds, there are possibilities of a reasonable increase in settlers and consequent production from such a source.

Subdivision of Semi-developed Land.

Semi-developed land falls under two headings: (*a*) Land described as native and tussock grassland, and classed as unimproved; (*b*) land which was originally in scrub, bush, or fern, and which has been burned and sown with English grasses, but has not been really exploited.

The first type does not offer great scope for improvement. Of the total area of native and tussock grassland, the North Island has 1,324,000 acres, and the South Island has 12,807,000 acres. It is all of low carrying-capacity, and is used mainly for store sheep and cattle. There are large tracts of the second type, particularly in the North Island, where climatic conditions make it possible to produce milking pastures on land-types which would not be considered dairying land in the South. The major cause of its present condition is lack of capital, combined with scarcity of family labour, and the fact that through a failure to realize the potentialities of the North Island land was taken up in blocks too large for settlers to handle. The exploitation of this class of country on a large scale would be perhaps the most economic and profitable type of land settlement and utilization which could be undertaken at the present time, as the capital required is not great, and some return could be secured immediately the land was occupied.

Improved Production on existing Farms by present Occupiers.

During the last decade the Dominion's increased production has not been as a result of an increase in area farmed. It has resulted from steadily improving systems of pasture and stock management. The increases recorded in dairy cows and in sheep during the past ten years make an impressive accomplishment, especially when it is remembered that the great increase has been in breeding-stock. The fact that butterfat production per cow has been raised from 152·04 lb. to 218·5 lb. in the same time is a further indication of improved management. Despite the advances which have been made in the past there is still tremendous scope

for improvement. There are large areas in both Islands where the ewe-wintering capacity of land can be increased. We have instances to-day of farms wintering four to six ewes on top-dressed pastures. If it can be done on isolated farms it can be done on surrounding country.

The great scope for improvement, however, is in the dairying industry. This improvement is being brought about through better breeding and selection of animals, the object being to secure a cow which is the most efficient machine for the conversion of grass into butterfat. When worked in conjunction with improved feeding, there seems to be no doubt that the New Zealand cow average will reach 250 lb. of butterfat within five years. With better feeding and improved cow yield the increase in per-acre production becomes automatic, and it is per-acre yield which is of paramount importance as a measurement of the industry's development.

Unfortunately, we are at present experiencing a period of price depression for primary products. It is difficult to say whether the cause is a temporary economic stringency, or a high degree of saturation. If it is the former only, then the position presents no great need for alarm. On the other hand, we know that all countries are striving to increase their output of live-stock products, as cropping, with its accompanying high labour demands, is in a languishing condition. Great Britain represents the best market for exporting countries, but her ability to absorb goods is not unlimited. Therefore it appears that the present price condition may be caused through a combination of the two factors noted, in which case we are entering on a period of lower price standards than enjoyed in the past.

There are three possible methods of meeting such a position: (*a*) Development of new markets; (*b*) reduction of the unit cost of production; (*c*) diversification of production and a consequent endeavour to capture a part of the trade at present held by other countries for goods which we do not at present exploit.

New markets are possible of exploitation, but the process is slow and very expensive. Although in time we may develop trade with Eastern countries, we cannot look to such an outlet for our products in quantities sufficient to effect a relief in the near future.

The unit cost of production can and is being reduced for some of our staple products. Wool and meat cannot be considered separately, but on the whole the sheep industry offers some scope. With a possible encroachment of dairying on to better-class sheep-country we cannot expect a great increase in the total flock. By improved pasture-management, and consequent specialization of lamb-fattening, the percentage of ewes to dry sheep should increase. An improvement in carrying-capacity of breeding-ewes will tend to lower the cost of meat-production. The cost of producing wool can only be accomplished as a consequence of a general reduction. A great deal of work is and will be done on the improvement of wool quality, and this should have some effect in raising values.

In the dairy industry a gradual expansion of the area top-dressed, the adoption of most up-to-date methods of grazing, conservation of surplus grass in the form of ensilage or hay, and a reduction in cropping for supplementary feed, combined with systematic culling of inferior animals through the medium of herd-testing data, are all tending to an increased per-acre production at a reducing cost per pound of butterfat. This is particularly noticeable when production is increasing above 130 lb. per acre. To bring this about more rapidly everything possible should be done to reduce the price of fertilizers to farmers, as it is primarily upon their liberal use that unit cost reductions depend.

There are great possibilities in the expansion of the pig industry as a side-line to dairying. Denmark occupies a most enviable position in the

supply of pig-products to the British markets. By a skilful exploitation of pigs as the consumers of skimmed milk and whey, this otherwise waste product is to-day almost as valuable as the butterfat and solids which have been extracted from the milk. Considerable difficulties have been met with in the transport and handling of pig-products from New Zealand, but they have been to some extent overcome. The great difficulty in the way of an expansion in this important industry is the prejudice of many farmers against keeping pigs, and to the high cost of grain which is necessary to supplement milk if our output is to greatly increase.

Poultry-products are in much the same position. With cheap grain and utilization of milk curd, eggs could be produced in larger quantities at a price considerably below their present cost, particularly if the birds were run on open range. With a low production-cost it would be possible to export eggs in larger quantities.

The diversification of farm activities will be gradual in realization, but with a lowering of butterfat values it will become imperative that these avenues of possible income be exploited. We are essentially producers of live-stock products for human consumption, competing with the countries of the world. Our economic existence depends on our ability to operate on world's prices, and it is therefore of vital importance to every section of the community that in the purchase of commodities required to produce such goods our producers should be enabled to operate on an equal footing with their competitors.

INVESTIGATION OF BLEACHING AND DISCOLORATION IN CHEESE.

In the course of his work in connection with dairy-factory difficulties coming under the notice of the Dairy instruction staff, Mr. G. F. V. Morgan, Dairy Bacteriologist to the Department of Agriculture, has found what appears to be a very evident cause of much of the bleaching and much of the dark discoloration which are met with from time to time in New Zealand cheese. His work indicates that this bleaching and discoloration, which are due to the presence of mould, are rendered serious through the mould being enabled to develop and extend in and around cracks or boreholes in the cheese, in which oxygen derived from the air is present.

The matter requires further and more extended investigation in order to fully confirm these opinions, and it has been communicated to the Dairy Research Institute, at Palmerston North, with which Mr. Morgan works in co-operation, where no doubt this will be carried out. Meanwhile all dairy companies possessing cheesemaking plants have been advised as to precautions necessary to be taken in order to prevent mould contamination of the body of cheese.

Good Example of Silage Utilization.—The Fields Instructor at Rotorua reports that a Putaruru farmer, who has a holding of 80 acres and milks thirty cows with an average butterfat production of slightly under 300 lb. per cow, last season wintered seventy head of stock and purchased seventy hoggets in July. He did not save any hay, and his herd was fed on silage alone up to the end of July, when he commenced feeding swedes. Silage feeding was continued during spring, and the stock came through in excellent condition.

SEASONAL NOTES.

THE FARM.

Top-dressing of Current Importance.

MANY important matters generally call for attention in April and May. Pasture top-dressing promises to be one of the most important of these. If for any reason top-dressing usually carried out earlier has not been done, it is well to remember that there is much in favour of April–May application of phosphatic fertilizers.

Phosphates applied in the April–May period can be expected to assist in the provision of feed for stock through the difficult July to September period. Hence any farmers who may have to face a probable July–September feed-shortage should strain their resources to the utmost to carry out top-dressing in April or May. In this category of farmers will be that extensive group which has not built up substantial reserves of silage or grown adequate supplies of roots and hay. Especially should farmers who are wintering more stock than they wintered last season give thought to the feed that is in prospect for July to September. Little but disappointment usually comes from increased stocking unless the greater number of stock is treated at least as well as was the previous smaller number. It is certainly late in the day now to take steps which will enable a greater amount of feed to be grown for the winter and early spring, but one of the things which will assist is suitable top-dressing. Pre-winter top-dressing generally begets specific valuable results which those who are proposing to practise spring top-dressing should not overlook.

In considering these results it is necessary to bear in mind that, as a rule, manures are used to the best advantage on New Zealand grassland only when, as far as possible, they even out the rate of grass-growth throughout the whole year. It is in this connection that pre-winter top-dressing with phosphates excels. In the first place, it gives increased feed when feed is often critically needed in late winter and early spring. In the second place, the increased winter feed resulting from autumn as compared with spring top-dressing means a smaller growth in summer, when there is no special need for extra feed, and when, in fact, it is often somewhat difficult to deal satisfactorily with additional grass-growth.

From this it is clear that, as a rule, pre-winter top-dressing assists in a most desirable way in levelling out the rate of grass-growth, and that a farmer must have a really weighty reason to justify his substituting a spring top-dressing for a pre-winter one. If it is impossible to carry out all top-dressing with phosphates in the autumn or early winter, a special endeavour should be made to carry out at least some of it in the autumn. When it becomes necessary to spread top-dressing over both autumn and spring it is usually advisable to select for autumn attention those fields which are best fitted to respond to stimulation during winter and early spring. Generally these are the well-drained fields, well sheltered, in which rye-grass is most prominent.

The period during which autumn top-dressing may be done is advancing. The matter is mentioned now because generally such top-dressing is better done somewhat late than not at all. But any considerable further delay is distinctly undesirable, particularly in the colder districts where the winter grass-growth is relatively low. If top-dressing is not carried out until close to the season when pasture-growth is at its minimum, then a considerable portion of the benefit already mentioned as coming from it will most likely be missed.

Treatment of Young Pastures.

Special care should be taken in the treatment of young pastures. The plants, having been given a suitable opportunity to establish themselves, should neither be allowed to become long and productive of flower-heads nor be continuously eaten down closely. To keep the plants desirably shortened back it is usually best to turn in a relatively large number of stock for a short time only. This avoids the selective hard grazing of the most attractive species, and the neglect of other species, which is apt to occur in cases of light stocking. Properly controlled grazing, which prevents too rank a growth during the youth of a pasture, leads to stooling-out of the plants, and consequently to a denser sward which more effectively covers the soil. Persistent close grazing of young pastures is especially harmful, because it means that the plants are not allowed to build up the strong root-systems upon which the future vigour of the pasture depends. Stock should not be grazed on young pastures if the ground is soft, as it is apt to be because of rain, for trampling of wet, soft ground will lead to killing-out of plants and poaching of the soil in such a way as to favour eventual invasion of weeds.

At times, for various reasons, certain species in a young pasture do not establish as successfully as could reasonably be expected under the conditions generally experienced in the locality. For instance, rye-grass plants may be weakly where rye-grass would be expected ordinarily to persist. In such cases at this season a top-dressing of sulphate of ammonia, usually in combination with superphosphate, may be advisable to build up the vigour of the young rye-grass and to enable it thereby to establish itself permanently. Particularly in the case of young pastures is increased fertility due to top-dressing likely to be worth while, because during a critical stage it assists superior plants to compete successfully against invading inferior kinds.

Harrowing of Pastures.

In the older farming countries the value of animal manure is rated so highly that costly and careful provision is made to bring about its most effective use. It is specially stored; special machines are manufactured for the purpose of distributing it on the fields; it is often the subject of legal provision in leases in order that there be no neglect in respect to it. This care in the older countries contrasts sharply with the neglect, and, indeed, the abuse, of animal manure in New Zealand farming.

The contrast is probably due to the fact that, as a rule, what we can obtain easily we seldom value properly. In New Zealand we can obtain the benefits of our animal manure much more easily than is the case in the older countries. And so it is not surprising that we value those benefits much less than do the older countries. From our system of farming it follows that storage of the manure is unnecessary, and that much, but not all, of the necessary distribution is brought about naturally. Yet many neglect the small and inexpensive attention which is needed here to satisfactorily complete distribution, and without which harm instead of benefit is apt to come from animal manure on our pastures.

This modicum of attention is supplied by suitable harrowing of the grassland. At this time of the year harrowing is often urgently needed on fields. This is because of the animal droppings which have accumulated as the result of heavy summer stocking. The longer these remain undisturbed the greater will be the subsequent development of those rank patches of growth which are definite evidence of ineffective utilization of animal manure. On the other hand, if they are thoroughly distributed in good time the fertility of the whole field is improved. Apart from its value in distributing manure, autumn harrowing of grassland is at times specially desirable in dealing with fields which are covered with matted growth which could profitably be broken and loosened.

Liming.

Lime may be applied to pastures in April or May. Superphosphate and ground limestone (carbonate) may safely be mixed, if desired, and applied as one dressing, but superphosphate and burnt lime should not be mixed, except when one is certain that the mixture will be distributed without delay. If a mixture of burnt lime and super is allowed to stand for any considerable time it will set into a hard mass. When superphosphate and lime are to be applied during the same period, but in separate dressings, the lime, if it can conveniently be arranged, should be applied before the superphosphate.

Approximately 2 tons of ground limestone are equivalent in their ultimate influence on the soil to 1 ton of burnt lime (100 lb. of ground limestone is equivalent to 56 lb. of burnt lime when both are pure). As a general rule, considering only the effect on the soil, it is not of material importance whether ground limestone or burnt lime is used, provided the dressings of limestone are about twice as heavy as those of burnt lime. Hence their relative costs generally should determine which of the forms of lime should be used. Certain special circumstances, however, may lead to departure from this rule. For instance, if speedy action of the lime is desired, as in the removing of soil-sourness for the better control of crop-disease such as club-root, then burnt lime should be used. Again, the cost of transport and handling, as distinct from the cost of material, if relatively heavy, may justify preference for burnt lime, as it gives a similar soil-effect with approximately half the material. Indeed, the costs of transport and handling are at times so heavy as to make expenditure on liming either not worth while or at least not as attractive as expenditure on other top-dressing material, such as phosphates.

Ordinarily supplies of lime in the soil tend to be depleted because the lime is washed down and leached away. Hence the working of lime into the soil is to be avoided as simply a means of hastening loss.

Adoption of Grass Ensilage.

It is extremely likely that next year, profiting from the experience of neighbours, many more farmers will adopt the practice of grass ensilage for the first time. Particularly to those who are adopting ensilage for the first time, but also to many others who have already had experience with it, a word of warning may fittingly be given now in respect to feed reserves. The fact that it is intended to save grass silage for the first time next summer gives little, if any, justification for slackening off in regard to special feed provision during the coming year.

This should be kept in mind constantly when planning the next year's cropping programme. In introducing any sound farming system in which ensilage is a feature an essential initial step is the building up of feed reserves sufficient to enable one to face without anxiety an unfavourable period in which there may be not only a minimum amount of surplus summer grass-growth available for ensilage, but also a specially heavy demand for reserve feed. If proper building up of feed reserves is not carried out it is easy to imagine the state of affairs should the first year in which it is proposed to make a feature of ensilage mark the commencement of a period of unfavourable conditions for grass-production. The feed saved through ensilage would be scant, and if the ensilage were not accompanied by the growing of other special crops, then the autumn and particularly the following winter would be trying times. Safety as regards feed provision should be a first consideration. Ensilage is an excellent means of gaining and maintaining a safe position, but it is most unwise, as the above considerations illustrate, to abruptly transfer dependence in a marked degree from special crops such as turnips and mangels to ensilage.

Possibly for the first year in which it is proposed to have silage available it would be well to plan the cropping programme in such a way that in ordinary circumstances there would be need to utilize but little, if any, of the silage. This would immediately create a good foundation of reserves for the future. Certain objections will readily occur in connection with substantial reserves of silage. While some of these objections are real enough, they are not of equal moment to proper reserves of feed. Absence of proper reserves of feed constitute one of the weaknesses of our farming. Few practices could be more unprofitable than underfeeding of stock at critical periods, or compulsory selling of stock at those inopportune times when many others are on the market as sellers. These are the dangers involved by absence of proper feed reserves which still occurs so frequently.

Land Tillage, &c.

At this stage no opportunity should be missed of cultivating land for spring sowing. In many localities autumn cultivation is valuable as a preparation for such crops as mangels, carrots, potatoes, and lucerne. Lea land can at times be worked safely when similar adjoining land, which has been under the plough recently, is too wet, and so it is fortunate that it is often lea land which benefits most from late autumn and early winter cultivation. The autumn and early winter skim-ploughing of lea, followed by disking, leads to thorough breaking-up of the turf and mellowing of the tilled layer, and leaves it in splendid condition for the deep spring ploughing.

For advice regarding such matters as fertilizers and seed-treatment of cereals, grain-growers, who will be particularly busy at this season, are referred to the notes which appeared last month.

Autumn Crop Utilization.

In both the animal and the plant worlds the immature is as a rule tender, delicate, and less well able without injury to undergo hardships which it could endure as an adult. For farm stock winter is apt to be a time of hardship, and because of their immaturity calves and hoggets are likely to suffer most severely unless they receive good attention. By being brought into contact with hay and silage when they are still in good condition and still have access to other feed, calves should be trained to eat these fodders before the time when they will be called upon to depend on them, and thus avoid the setback which sudden considerable changes in feed at times cause.

In like manner, hoggets should be given the best treatment possible. They may well be given the run of fodder crops before they have become low in condition. Changes in their feed should be arranged gradually, and, if possible, they should be given a run-off on a suitable pasture—one which is clean, short, and fresh.

In the case of good dairy cows much can be done by proper feeding during the "off-season" of low production to beneficially influence subsequent production. The good cow naturally uses the season of low production to build up bodily reserves which stand her in good stead under the strain and drain of a high-production season. She can, however, build up bodily reserves only if she receives the material which is needed in the creation of reserves. In practice this means that she needs to be well fed when she is not actually producing just as much as when she is producing heavily. It has been freely remarked of cows really outstanding as producers that they showed ability to milk-off bodily condition. It may be taken that their high production depended to some extent on this ability. The point of importance is that the ability would have availed nothing if they had not been fed in the first place in such a way as to have developed the condition which subsequently influenced production. In short, producing-ability without good feeding during the low-production period would

not go far. Considerations such as these serve to make clear the error of the policy of keeping dairy cows on short rations as soon as they have almost or wholly ceased to produce for the season. For special purposes such a policy may be defensible, but, as a rule, it is economically unsound, and the greater the producing-capacity of the cows the greater is the harm that is done.

The trampling and the firming of lucerne fields which certainly result from grazing during autumn and winter should be avoided if at all possible. Lucerne, when thriving, is such a valuable crop that no avoidable causes for its deterioration should be permitted to operate if it is practicable to eliminate them. Autumn and winter grazing of lucerne is definitely a cause of deterioration.

—R. P. Connell, Fields Division, Palmerston North.

Mineral Licks for Stock.

The value of a lick, either for cattle or sheep, must be in proportion to the deficiency in the soil of the particular mineral or minerals attempted to be replaced by the lick. For example, on farms in which bone-chewing in cattle is observed, the feeding of bone-meal (calcium phosphate) is followed by good results. Replacement in medicinal form, as by means of a lick, however, should be regarded as only a temporary expedient, the radical remedy being to replace in the soil by suitable top-dressing the phosphatic element in which it is deficient. This not only benefits the animal's health, but also increases the quality and quantity of the pasture plants.

The basis of all licks is common salt. Salt itself is essential for the maintenance of health, and has been used for stock since time immemorial.

Iodine deficiency has of recent years come very much under notice, and has been mentioned as a direct or indirect cause of many nutritional troubles of stock. Iodine deficiency has not been shown to exist generally in New Zealand, but in some districts the use of iodine may be followed by good results. The physiological requirement of iodine in the animal system is very low—for the cow about 1 grain per day, for sheep $\frac{1}{3}$ grain, and for pigs about $\frac{2}{3}$ grain daily. Probably the easiest method of administering iodine is by dissolving 3 oz. of potassium iodide in $\frac{1}{2}$ pint of lukewarm water; this is sprayed over 100 lb. of dried salt, and well mixed; when dry the salt is placed out in boxes for sheep or cattle. There is considerable evidence to show that the giving of small quantities of iodine to brood-sows is useful—a convenient method of administration is by dissolving 1 oz. of potassium iodide in 1 gallon of water and mixing a a tablespoonful of this solution in the food daily.

It is not possible to prescribe licks suitable for all districts alike, as local conditions often vary considerably and some localities have very special requirements. The following formulas, however, may be recommended for average conditions where the use of licks is desired:—

Cattle: Salt, 28 lb.; bone-meal, 50 lb.; air-slaked lime, 20 lb.; sulphate of iron, 2 lb.: total, 100 lb.

Sheep: Salt, 40 lb.; bone-meal, 38 lb.; air-slaked lime, 15 lb.; sulphate of iron, 2 lb.; sulphur, 5 lb.: total, 100 lb.

If the farmer wishes to include iodine in either of these licks, it can be added by dissolving 3 oz. potassium iodide in $\frac{1}{2}$ pint water, spraying this over the other ingredients, and mixing the whole well.

Finally, it should be realized that entire reliance cannot be placed on licks as a method of administration of minerals. Difficulty often exists in getting stock to take licks, and, furthermore, exact dosage by means of a lick is obviously impossible.

—Live-stock Division.

THE ORCHARD.

Preparing for Winter Operations.

ALTHOUGH the harvesting and packing of apples and pears will still be occupying most of the time of orchardists, in intervals of broken weather opportunity should be taken to prepare for operations which need attention during the early winter, such as drainage, increased shelter, overhaul of spray plant and implements, cultivation, manuring, and liming.

Drainage.

Most orchard properties can be improved by drainage, and with many it is a matter of urgent necessity if the trees are to be maintained in good health and maximum productivity. The beneficial results attained by adequate drainage—aeration of the soil, uniformity of temperatures, improved mechanical condition of the soil, and removal of excessive moisture—are often not fully appreciated, especially with regard to the conversion of organic matter and mineral substances into plant-food. Where drainage is properly established nitrification is not only accelerated, but it is also induced to a greater depth than would be the case where drainage is neglected, the secondary effect being that deeper rooting of the plant is encouraged.

In heavy and retentive soils stone drains are ideal in action. If material exists in the form of large stones close to the property, these drains will be found inexpensive to construct and practically everlasting. Tile drains can be recommended for use in light lands, being not so vigorous in action. They will also give satisfactory results in clay soils when stones are not procurable.

Shelter.

The value of shelter for fruit-trees is becoming better realized each year, now that the effect is more apparent. Increased growth and an improved general condition of the tree is invariably to be noticed. Good preservation of the foliage and reduction of transpiration are the contributing factors to this condition.

The kind of tree to be utilized for the purpose of shelter must be decided by individual conditions and requirements. Where the shelter can be planted at a distance of at least a chain from the fruit-trees, insignis pine or Lombardy poplar can be recommended. If the shelter is to be grown in close proximity to the fruit-trees, Lawson cypress or black wattle would be suitable fast-growing trees.

To ensure rapid growth of the two last-mentioned conifers it is essential to sow the seed *in situ*.

Overhaul of Plant.

Defects which have occurred in spray plant or implements during the past season should be rectified while the faults are fresh in the minds of users. Improvements in plant are also best considered at this time of the year, in order that any extensive alterations may be spread over the dormant season. The preservation of rubber hose is often too casual, orchardists hanging up expensive lengths of hose in the sheds exposed to the destructive action of air and light. A better method is to coil the hose in a cask or tub of water, or else submerge it in water in the spray-vat. Submersion in water will considerably add to the life of all rubber goods, and should be more common in practice.

Orchard Sanitation.

Orchard sanitation, which is so closely related to the general health of the trees, should be considered particularly in autumn. Diseased fruit should be gathered from the trees and also from the ground. Prunings

which may be lying around from the previous season should be carefully burnt, remembering that fungus growths are to a great extent saprophytic. Trees which have shown signs of root affection should receive investigation for canker infection. Applications of burnt lime may also be regarded as contributing towards a healthy and hygienic condition of the orchard, inasmuch as lime in this form will neutralize sour or acid conditions, which generally may be regarded as conducive to fungus growths.

—M. Davey, Orchard Instructor, Mapua.

Citrus-culture.

In last month's notes reference was made to the necessity for persons intending to make fresh plantings to order the trees early. Nurserymen do not work up unlimited stocks, and those who order early get the pick of the trees, this often leaving only those which have not developed as well. It is usually the case that those trees which have grown best in the nursery will come away much better when planted out in the orchard, providing always that the conditions there are good.

This brings us to another factor which often contributes to failure—that is, unsatisfactory preparation of the soil. This, combined with poorly grown trees, is what growers should specially try to avoid. Before planting out citrus-trees every consideration should be given to shelter, drainage, and preparation of the soil. It is very often time saved even to wait for a year, and perhaps longer, in order to get the right conditions.

If natural shelter does not exist, then steps should be taken to provide some quick-growing trees that will give protection to the young tender citrus. If they are exposed to the cold winds so frequently experienced during the spring, growth will be retarded if not altogether prevented. It is essential that any class of fruit-tree should be planted under congenial conditions, in order that the young trees may commence growth without undue delay. Not only shelter but also good drainage is essential, as no trees can be expected to develop into strong healthy specimens if the soil is damp or inclined to be waterlogged. Therefore the greatest care should be exercised when selecting a site for planting of citrus.

Thorough preparation of the soil by way of cultivation should in no wise be neglected. The land should be turned up some time before it is required for the trees. The more time and labour spent in preparation of the soil the better will be the results obtained. The best advice in regard to this matter is to make haste slowly and spend plenty of time on the details that so often make for success. Citrus-trees will often pick up one, two, and even three years, so long as they are given suitable conditions.

The points may be summed up as follows: Secure good trees by ordering early. Select a good sheltered site or provide shelter before planting. Provide good drainage and thorough preparation of the soil. Success is then bound to follow, providing subsequent operations are carried out satisfactorily.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Colds and how to prevent them.

At this period of the year birds are apt to contract colds, especially developing stock which has been late hatched. Almost always the trouble is caused by draughts in the roosting-quarters, or insufficient ventilation in a stuffy, closed-in house. Especially is this the case if the quarters are overcrowded. Obviously, if the birds are subjected to such conditions they become overheated during the night, and are highly susceptible to chill immediately they go out of doors.

When it is observed that dust and dirt are adhering to the nostril it is a safe indication that the birds have contracted a cold, the nasal discharge causing the adherence. In severe cases the discharge will usually be found on the feathers under the wing, by reason of the bird sleeping with its head thereunder. When once the trouble has reached this stage the bird rapidly loses weight, and its general appearance indicates an unthrifty and feverish condition. For the latter reason it will drink to excess, and will show little inclination for food or exercise.

As soon as these signs are observed the affected birds should be promptly isolated. The next step should be to find the cause of the trouble and have it removed at once. There are so many things which may be responsible for fowls catching cold that it is usually necessary to look for the cause in several quarters, and local conditions must always be taken into consideration in this respect. Even where the modern, deep, partly open-fronted, lean-to style of house is provided the poultry-keeper must be always on the alert to make sure that, while good ventilation is provided, the birds are not sleeping in a draught. The slightest crevice or crack near where birds are roosting is apt to cause an outbreak of colds. A good way of ascertaining whether or not the birds are sleeping in a draught is to visit the house by night and hold a lighted match or candle along the walls near the roosts. If there are indications that a draught is present the matter should be corrected at once.

Special care should be taken to have the partitions dividing the house absolutely airtight, and therefore the intersecting walls should be made of some such material as asbestos-slate, beaver-board, &c. If a partition is to have the desired effect it should stretch the full width of the house, and not merely a few feet from the back wall. Although plain 1 in. boards are commonly used for partitions they are unsuitable for the purpose, particularly under varied climatic conditions, for the reason that they can seldom or never be regarded as absolutely draught-proof, unless, of course, they are covered with some airtight substance such as cheap roofing-material. Most of the cases in which I have been called upon to advise regarding troubles having their origin in colds could be traced to the intersecting walls not being draught-proof. Even one small crack close to where a bird is roosting may cause no end of trouble. This may give only one bird a cold, but if not checked at once the whole flock may soon become affected, particularly through the drinking-water.

Another frequent cause of cold lies in having the perches too high from the floor, and this applies particularly where the break-wind or the boarded-up part of the front of the house is lower than the level of the perches. It will always be found that the lower the perches the greater the comfort of the birds during unfavourable weather conditions.

As is the case with all troubles affecting poultry, prevention in dealing with colds is always better than remedial treatment, but when colds have made their appearance treatment is necessary. Prompt measures should be taken, for too often the neglected cold develops into the dangerous roup, at which stage the breath becomes offensive, while usually one eye becomes swollen, and finally a cheese-like substance protrudes from it. When this stage has been reached little or nothing can be done for the bird, and usually the best course is to kill it and burn the carcass.

As soon as fowls show symptoms of the slightest cold being present they should be at once isolated and placed in comfortable healthy quarters. A good treatment is to hold the beak in kerosene in such a way that the nostril is submerged, and to hold it there until the bird breathes. The kerosene will then be drawn to the seat of the trouble. This should effect a cure after several applications. Before treatment any adhering matter should be removed from the nostrils, while after each operation any kerosene remaining on the beak should be wiped off with a dry cloth, care being

always taken that no kerosene gets on the face, as if it does blistering will probably follow. A little Condy's fluid placed in the drinking-water, sufficient to give it a rich pink colour, will generally prove effective in checking the trouble. All drinking-water may be thus treated during a season of the year when colds are probable.

Leg-weakness.

Several inquiries have been made lately regarding well-grown cockerels losing the power of their legs. This is one of the troubles affecting poultry which prevention is the only way of fighting. The invariable cause is insufficient exercise and the feeding of rich forcing foods. Many poultry-keepers, after selecting the most promising cockerels for future breeding purposes, in a desire to "do them well" subject the birds to strictly confined quarters, probably a coop, and provide them with a highly forcing diet. This is a mistake, for it stands to reason that feeding rich foods to birds confined in a small run or coop will have the effect of encouraging size of body beyond the point which the undeveloped legs are capable of carrying.

Naturally, where birds are to be marketed young and in prime condition, forcing food as well as confined quarters are necessary, so that the bird may make the greatest growth possible in the shortest space of time.

The highly forced male is not one to be regarded as a desirable bird for leading the breeding-pen. The fact of a bird being weak in the legs indicates that it has an hereditary weakness or that its constitutional vigour has been weakened through improper management. The developing cockerel intended for the breeding-pen should be provided with a good range, which is one of the best means of building up bodily vigour. Where this is not available the bird should be compelled to exercise by providing ample litter and feeding the grain food in it.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Management of Supers and Winter Stores.

THE removal of the supers should go on steadily as the bees form their winter clusters. In the case of very strong colonies it will often be found difficult, if not impossible, to confine the bees to one story without seriously diminishing winter stores and unduly crowding the bees. In these cases it is best to leave the super on till the spring.

The best place for winter stores is in the hive, and, however careful the beekeeper may be in replenishing these, if the honey is removed from the hives and is not within reach of the bees at all times during the cold weather, there is still the risk of allowing them to starve out. There are very few districts in New Zealand where brood-rearing absolutely ceases during the winter, especially when the hives are well sheltered, and the bees require food at all times and seasons. On no account, however, should they be allowed to winter in more than two stories. In many cases they will be showing a tendency just now to go as high as they can get in the hives, and where this happens it will usually be found that the combs in the bottom story are deserted and dry. A rapid examination will soon show the beekeeper whether this state of affairs obtains, and, if so, he should remove the bottom story, leaving the cluster undisturbed.

Where queen-excluders have been left on the hives they should now be removed, because it sometimes happens that the bees will go through the excluders to the stores above, leaving the queen to perish below. There is always a tendency for the cluster to move to the warmer part of the hive, and an excluder will not act as a bar if the bees are dissatisfied with the lower story.

Mats for Wintering.

To ensure that the bees are kept warm through the cold weather it is absolutely necessary that the frames should be well covered with good mats. Three or four are by no means too many to provide for each hive. Ordinary corn-sacks cut into pieces the size of a zinc queen-excluder answer the purpose admirably, and are very durable. Avoid using calico mats, as these are next to useless for wintering purposes. It is essential that the mats should fit exactly over the frames; if too small they admit draughts, and if too large the edges will protrude beyond the hive-covers, and in wet weather these will absorb sufficient water to cause the mats to become damp and unhealthy and the combs mouldy.

Clearing Weeds.

Weeds should be kept down. A good clearing of the weeds round the hives in the autumn will suffice until the spring, and will add materially to the comfort of the bees and the well-being of the hives during the winter months. Not only should the entrances be cleared, but the ground all round the hives should be similarly treated, and the weeds raked up and destroyed.

Care of Utensils.

Utensils that have been in use during the extracting season should be thoroughly cleansed prior to storing away for winter. Remove all traces of honey from the extractor, tanks, uncapping-knives, &c., washing with boiling water, and drying thoroughly to prevent rusting. All metal parts liable to rust should receive a coating of oil. The cost of renewing working equipment is becoming a serious burden on the profits of the apiary. By a little judicious care and management the life of a beekeeper's working equipment can be prolonged; much of the expense incurred in replacing damaged utensils is usually the result of sheer neglect. Loose washing covers should be made to cover the extractor and tanks in order to prevent these utensils getting coated with dust, which is likely to accumulate during the off-season.

Care of Hives.

At no other season is the welfare of the hives of such importance as during the next few months. Every hive should be raised from the ground the height of one brick, and if the situation is damp or low-lying it is a good plan to raise the hives still more. This will tend to keep them free from slaters (wood-lice) and other insects, and will afford less harbour for mice, as well as ensuring that the hives have a free current of air beneath the bottom-boards and thus are more likely to keep dry. Never rest the bottom-boards on the ground, or they will rot in a very short time and become mouldy and evil-smelling.

Before bad weather sets in it is a good plan to give a coat of paint wherever it is needed, at the same time stopping up all cracks in the supers. Cracks afford ventilation during the summer months, but they are hardly to be advocated on that account, because the beekeeper will usually find that towards the end of the honey-flow the bees will use up much valuable time in gathering propolis to fill up the cracks in view of the approach of winter. The hives should be slightly canted forward, so that any rain which falls on them will drain off the alighting-board.

Leaky Hive-covers.

Apart from disease, there is no worse feature in an apiary than the presence of leaky roofs. A cover which allows moisture to trickle through is a constant menace to the colony it appears to shelter. Not only will the mats immediately beneath it become sodden and mouldy, but the cluster of bees in the hive stands in danger of extermination when frost sets in. There will then be pollution on the bottom-board, where the

intruding moisture mixing with dead bees and waste pollen forms a rotten fermenting mass, with a stench which the order-loving bees must find even more obnoxious than does their owner.

There is no excuse for leaky covers. In the autumn the apiarist should examine them for any doubtful spots, and, where necessary, should cover them with zinc, ruberoid, or some other waterproof material. Or, if economy must be practised, he should cover with cheese-cloth, applying to the roof first a coat of paint, then the cheese-cloth, and then another coat of paint. This makes an effective waterproofing, and which anybody can apply.

—E. A. Earp, Senior Apiary Instructor, Wellington.

HORTICULTURE.

The Market Garden.

THE three- to four-year period is an important one in the market-garden class of cropping. After such an interval most perennial herbaceous crops, such as rhubarb, require to be divided up and planted out in fresh ground. It is then desirable to break up the plough-sole to deepen fertility; also to give attention to the important matter of making a special application of lime to freshen the land and correct unwholesome conditions.

Land used for this class of intensive cultivation is naturally heavy, often only moderately well drained. It is given heavy dressings of manure at all seasons, and is almost continuously under crop. Under the best management, and still more, probably, under management less experienced, an application of lime to such areas at the present season, when it will have time to effect its beneficial action before the land is replanted in early spring, is very desirable. So liberally are manures and cover-crops sometimes applied that the land becomes infested with collembola and millepede insects and the spores of fungous diseases. Attention to drainage and a full dressing of lime on a heavy soil in this condition greatly improves the succeeding crops.

Where land is being prepared for such permanent crops as asparagus or rhubarb, it is necessary to clean it well and cultivate it deeply, thus enriching the ground by deepening, perhaps doubling, the top fertile stratum, as well as improving its drainage. It is a good plan to give this treatment to an area of about one-quarter of that under crop of all kinds each winter. It is usually accomplished by what is called double ploughing—that is, a second single-furrow plough, with its mouldboard removed, follows the first and breaks up the bottom of each furrow before it is covered by the next slice. A double depth is thus broken fine, and aerated so that the particles become oxidized and liberate the food they contain; also any manures applied are mixed with the soil to a greater depth or reach it better in solution. In these and other ways fertility is increased by periodical deep cultivation on soils of this class. On light friable lands, however, cultivation can easily be carried to excess, and for these even ordinary ploughing is often deferred until the spring.

Early peas and potatoes will be on the market about the month of October next. For these crops seed is sown now in the warmer localities.

Nature and Action of Lime.

The nature and action of lime is rather obscure to some, owing to the various forms in which it is used. Lime (calcium) is a soft yellow metal, and one of the commonest and most important elements in nature. It is usually found in combination with carbon, and is known as limestone, marble, or chalk. In this state it is spoken of as carbonate of lime, or calcium carbonate. Good limestone is almost pure carbonate of lime, and when finely ground it is sometimes applied with great benefit to land.

Between layers of a fuel of some kind, limestone is piled in a kiln and burnt for a period, with a slowly rising temperature. The effect is to drive off the carbon and leave the calcium in combination with oxygen. It is then spoken of as quick (live) lime, rock lime, or calcium oxide In this state it is actively caustic—that is, it will burn, especially organic material. It is also light in weight—so much so that a cubic foot of burnt lime (rock lime) would weigh about half the amount of a similar-sized piece of limestone (carbonate of lime). A lime-kiln is drawn from the base, and as the stone falls much of it is ground to a fine white powder. This is allowed to remain to cool, and by absorbing atmospheric moisture it loses some of its fiery nature; it is then bagged up and sold as agricultural lime. In this instance the burnt lime has absorbed a certain amount of moisture, which reduces its caustic properties, but it remains a dust. In this state it is referred to as lime (calcium) hydrate. By keeping rock lime in sealed containers or a tightly built store its caustic properties are preserved, but it quickly absorbs moisture at the first opportunity and crumbles into dust (hydrate), returning eventually to limestone by absorbing carbon from the air.

Lime has another quality that makes it valuable in agriculture. It is classified with potash, soda, &c., as an alkali—that is, a substance which combines with an acid and neutralizes it. An adequate dressing of lime applied to the land, then, radially changes its condition. It gradually acts upon organic matter such as animal and vegetable substances, and breaks them up. It has a similar action on inorganic mineral substances, liberates plant-foods, and improves the mechanical condition of the soil as well as neutralizing its acid (sour) condition. The conditions which favour many soil pests and diseases are thereby changed to those more favourable to the growth of crops.

In deciding the form and quantity of lime to be applied to the land it is necessary to consider the circumstances. Where land is to be planted immediately, a heavy dressing of burnt lime may be detrimental to the crops, and the finely ground carbonate form may be used. Also, in the case of light friable soils, strong caustic action is apt to be injurious and a light soil made lighter. It is the alkaline properties rather than the caustic that will be beneficial in such a case, so that the carbonate of lime is again preferable. However, in the case of heavy, perhaps overrich, and not well-drained land the lime hydrate is the better form of lime to be applied, as it is more active in every way, as well as having the advantage of being about double strength as compared with an equal weight of carbonate of lime, an advantage where long-distance transport is concerned.

The full effect of a soil-dressing of lime is not obtained as soon as it is drilled or broadcast and harrowed in. For that reason autumn is the best season for its application, so that the good effects may be present in time for spring cropping. One ton of burnt lime or 2 tons of ground carbonate is an average dressing per acre—equal, say, to ½ lb. or 1 lb. per square yard. Usually the burnt lime comes to hand as a hydrate, but if it is in rock form it can be quickly reduced to a powder (not paste) by sprinkling it with water to the extent of one-third of its weight. For instance, for 1 cwt. quicklime nearly 40 lb. (4 gallons) of water would be required. More often the quicklime is exposed to the air, from which moisture is gradually drawn. In the powder form only can an even distribution be made.

Insect Enemies of Crops.

The crop losses from insect enemies are extraordinarily great, although perhaps not always very apparent. Successful cropping depends very much upon an intelligent observation of what is taking place in the land and about the plants.

During a recent evening, about sundown, magpies were observed to be actively feeding on the grassy slope of a hillside. The unusual

activity attracted attention, and curiosity led to an examination of the spot, when it was found that a host of click-beetles (*Agriotes*) were climbing from their daytime hiding-places under the grass-plants up into the higher stalks. Magpies and starlings just walked among them and picked them off at a great rate. This shabby-black, narrow-bodied beetle is about ¾ in. long and very active. If placed on its back it instantly springs into the air and generally lands on its feet; this it will continue to do in quite a tireless manner, demonstrating its appropriate name. Crops are damaged very seriously by this insect, chiefly during its slow-moving larval stage of growth, when it is known as wireworm—a stage in which it probably remains for a few years. At the present time egg-laying is taking place; the egg, after an interval of about a month, hatches out as a young wireworm, and soon commences to feed on the underground portions of most plants. White mustard and rape are perhaps the least attractive to this pest—so much so that they are commonly considered to be immune from attack.

The lesson to be learnt from this interesting observation is that undisturbed grassland in general, and this area in particular, is probably badly infested with wireworm. Further observation will probably show that it is also infested with the lethargic caterpillars known as "cutworms," the larvæ of common moths; also cylindrical legless grubs that appear to be lifeless and are known as "leather-jackets," the larvæ of the crane-fly, or daddy-long-legs. The damage done annually in a country by these insignificant creatures must be enormous; but experience has proved that if one is breaking up grassland for cropping, and starts early and does it well, there is usually no loss from these causes. The early and continued disturbance by ploughing and cultivation is an injury that destroys great numbers, and others are eaten as soon as they are exposed to the extraordinary sharp eyesight of the birds which are their natural enemies; there are other benefits to be obtained from early and thorough preparation of grassland for cropping; in fact, if there is any royal road to successful cropping it is this.

Since the foregoing note was written, crane-flies (daddy-long-legs) emerged from the ground about the middle of March in the vicinity of Wellington, the flight appearing to be a moderate one. Contrary to the usual case, wet damp conditions are preferred by this insect.

Small Fruits.

On well-prepared land bush fruits may be planted out now in fine weather as soon as the plants are available. For the first season, while the young plants are becoming established, intercropping with shallow-rooting crops such as lettuce, peas, and French beans, may be done with advantage. In Northern districts new strawberry-beds are planted at this time.

Established plantations of bush fruits should be given a good dressing of decayed farmyard manure where this is available, or in its absence a dressing of bonedust and kainit, and lightly ploughed in.

Herbs for the Homestead Garden.

An enclosed garden for perennial vegetables, such as asparagus and rhubarb, also small-fruits and herbs, has been recommended in previous horticultural notes in the *Journal*. Many a culinary dish would be more wholesome and appetising if suitable fresh herbs were used with discretion in its composition. Their cultivation is a phase of production that is rather neglected in this country. Others have been used for their perfume or medical qualities from the beginning of history. A selection may be made from the following list of the more popular kinds. All of them are quite hardy, except where otherwise mentioned.

Shrubby plants: Lavender, hyssop, rosemary, rue, sage, winter savory, common and lemon thyme.

Perennial herbaceous: Balm, chives, spearmint, tarragon, and wormwood (*Artemisia absinthium*).

Biennial herbaceous: Angelica, and caraway.

Annual plants: Chervil, coriander, dill, parsley, purslane, summer savory, also basil and sweet marjoram. The last two should be treated as half-hardy annuals.

The herbaceous perennials, like all other of their class, require to be lifted, broken up and replanted in fresh ground every two to three years. They all require sunny well-drained positions to develop their aromatic qualities. Spearmint and angelica are exceptions in requiring more moist conditions.

—*W. C. Hyde, Horticulturist, Wellington.*

WEATHER RECORDS: MARCH, 1931.

Dominion Meteorological Office.

MARCH was a very dry month practically throughout the country. Fortunately, there were comparatively few strong winds and most of the rainfall was of a steady nature. These conditions, together with the cool temperatures, were responsible for the maximum amount of good being derived from such rain as fell. At date of writing, in most districts further considerable rains are nevertheless required if supplies of winter feed for stock are to be adequate. At present stock are, on the whole, in good condition, and crops have harvested well. In the greater part of the Hawke's Bay and Poverty Bay districts, where rain was most needed, there were good falls towards the end of the month and the situation was considerably relieved. In parts of South Auckland, the Bay of Plenty, Taranaki, Manawatu, and Wairarapa districts, stock are feeling the effects of continued low temperatures and rather scanty feed.

Rainfall.—On the average for the whole Dominion the rainfall was only about half the normal total for March. In the North Island it was considerably less. The only places where the normal fall was approached were Poverty Bay and parts of the west coast of the South Island.

Temperature and Sunshine.—Temperatures were everywhere below the average for March. In the North Island the deficit was between 2° and 3° F., but in the South Island it was considerably less. Sunshine was rather above the average, so that good harvesting weather was experienced.

Pressure Systems.—At the beginning of the month anticyclonic conditions prevailed, and the weather was generally fine until the 10th. Between the 10th and the 12th a moderate depression passed, and rain was almost general, though only light to moderate in amount.

The next depression passed between the 15th and 18th, and again there was widespread though mainly light rain. A slight cyclonic centre developed in this depression and crossed the South Island on the night of the 17th. Thunderstorms were experienced, Christchurch recording an unusually severe one.

After another spell of anticyclonic and fine weather, a third and rather similar depression crossed the Dominion between the 21st and the 24th. On the 23rd there were again some thunderstorms in the South Island. In the North, many parts of the Auckland Province had heavy rain.

The last depression controlled the weather between the 26th and 28th. As it passed, many parts of Auckland recorded heavy rain. Pressure

RAINFALL FOR MARCH, 1931, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average March Rainfall.
	North Island.	Inches.		Inches.	Inches.
1	Kaitaia	0·48	7	0·20	3·30
2	Russell	0·82	7	0·60	3·10
3	Whangarei	1·08	6	0·88	4·56
4	Auckland	0·83	11	0·21	3·08
5	Hamilton	1·47	7	0·73	3·99
6	Rotorua	1·27	5	0·50	3·61
7	Kawhia	2·80	9	1·67	3·66
8	New Plymouth	1·48	9	0·78	3·67
9	Riversdale, Inglewood ..	3·50	9	1·33	7·30
10	Whangamomona	2·48	10	1·02	5·34
11	Eltham	0·51	9	0·15	4·41
12	Tairua	0·39	4	0·25	5·71
13	Tauranga	1·53	10	0·44	4·17
14	Maraehako Station, Opotiki	2·60	13	0·60	4·29
15	Gisborne	4·38	7	2·05	4·48
16	Taupo	1·43	7	1·02	3·34
17	Napier	2·14	10	1·08	3·24
18	Hastings	1·50	8	0·58	3·00
19	Taihape	1·44	9	0·44	2·88
20	Masterton	0·78	12	0·25	2·98
21	Patea	0·71	7	0·78	3·61
22	Wanganui	0·94	6	0·36	2·60
23	Foxton	0·34	4	0·25	2·22
24	Wellington (Karori Reservoir)	0·62	11	0·17	3·45
	South Island.				
25	Westport	5·90	11	2·15	7·50
26	Greymouth	5·76	10	1·29	8·91
27	Hokitika	8·66	15	2·24	9·88
28	Ross	11·56	12	3·90	11·33
29	Arthur's Pass	..	..	..	11·91
30	Okuru	12·53	13	6·02	15·03
31	Collingwood	5·62	8	3·26	5·99
32	Nelson	0·74	8	0·21	3·06
33	Spring Creek	0·23	2	0·13	2·23
34	Tophouse	2·73	7	0·90	4·62
35	Hanmer Springs	1·70	11	0·52	3·07
36	Highfield, Waiau	0·97	5	0·40	2·99
37	Gore Bay	1·37	7	0·33	2·38
38	Christchurch	1·00	10	0·52	2·03
39	Timaru	1·56	12	0·36	2·29
40	Lambrook Station, Fairlie ..	1·95	5	0·62	2·45
41	Benmore Station, Clearburn	1·27	8	0·45	2·79
42	Oamaru	1·57	9	0·78	1·86
43	Queenstown	0·74	6	0·19	2·74
44	Clyde	1·08	4	0·81	1·55
45	Dunedin	1·30	15	0·27	3·04
46	Wendon	1·04	12	0·19	2·91
47	Gore	..	..	..	3·25
48	Invercargill	1·64	17	0·48	3·96
49	Puysegur Point	3·90	22	0·77	8·59
50	Half-moon Bay	3·27	14	0·78	5·74

remained low to the east, and in the East Cape, Poverty Bay, and parts of the Hawke's Bay districts rain continued till the 28th. Some very heavy falls were experienced around Gisborne, where droughty conditions had ruled since the beginning of October. Temperatures were cold during this spell.

There was a prevalence of southerly winds during the month.

—Edward Kidson, Director of Meteorological Services, Wellington, 8/4/31.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF CALVES FOR LICE.

J. H., Collingwood :—

Towards the end of last winter, which was particularly hard on stock, a number of calves were very badly affected with lice. I treated twenty-odd of the worst by applying fat, but left the remainder, under the impression that the lice would disappear as seasonal conditions improved. This has not proved altogether the case. All calves are bush-reared, and I find when docking this season's calves that they are also rather badly affected. There are, say, 200 young cattle, including this and last season's calves. What can be done to eradicate the lice before the winter comes? I presume that it would be unnecessary to treat the cows, but the calves would have to be treated when weaned in, say, May. The cattle generally are in good store condition. Could they be put into a cattle-race and a spray used?

The Live-stock Division :—

Young calves often become infested with lice during the autumn and winter months. This trouble is commonly seen among calves in low condition. With a herd of 200 hand treatment cannot be considered, and spraying or dipping are the two alternatives. The cost of erecting a special dip for treating this trouble does not appear to be warranted. If the calves are closely packed in a race and spraying is carried out and repeated within ten days, a considerable improvement should be effected. An ordinary orchard sprayer should prove suitable; any adjustments considered necessary may be carried out. The choice of the spraying-material lies between a non-arsenical dip, as used for dipping sheep, and a kerosene emulsion of soap and water. The latter solution is prepared by dissolving ½ lb. of soap in 1 gallon of hot water, and while still at near boiling-point adding 2 gallons of kerosene. Thoroughly agitate by using a force-pump or other means to form an emulsion. Dilute one part of emulsion with ten or twelve parts of water. Preparations of kerosene should not be applied to sweating animals or while they are exposed to hot sunshine. The soap-kerosene emulsion may give more satisfactory results than the sheep-dip. A double spraying within ten days is essential to success, the second spraying killing lice which have hatched out since the previous spraying.

FEEDING RAPE TO DAIRY CATTLE.

W. R. HARVEY, Mount Bruce :—

I am interested in the question of feeding rape to dairy cows. I have been told that it will induce temporary sterility, and that even if fed in early autumn it will adversely affect the cows in the following spring. Can you inform me on this matter?

The Live-stock Division :—

Rape is not considered a very satisfactory feed for dairy cattle. When so used it is necessary to feed immediately after milking if taint in the milk is to be avoided. There is a decided danger of cows becoming blown on this crop. A run-off on grass must be provided and care taken to avoid bloating. There is also a tendency for cows fed on rape to be affected with diarrhœa, and rock salt in the grazing is recommended. We have no evidence that the feeding of rape has any bearing upon temporary sterility in dairy cattle, but severe bloating will cause abortion among pregnant animals. Provided care is taken on the lines mentioned, a rape crop may be fed off with dairy stock. Rape scald is sometimes set up when this crop is fed-off with sheep, and a similar condition of dermatitis in cattle, especially in non-pigmented areas of the skin, must be guarded against; such a condition is more liable to be set up in bright sunny weather. There is no evidence that rape will have a deleterous effect on stock at a later period.

ANT HOLES IN LAWN.

A. CAMPBELL PEARCE, Featherston :—

Could you please tell me how to best get rid of ants in a lawn. The soil is light and sandy, and there are many holes about 6 in. deep and 4 in. across which at the bottom are alive with ants. Is there any top-dressing I could give the lawn that would kill the ants? I have been putting kerosene in the holes and filling with earth and a sod on top. They have nearly ruined my tennis-lawn, and I know of other lawns in the district similarly affected.

The Horticulture Division :—

To get rid of ants at the bottom of holes in a lawn such as you mention, pour in a teaspoonful of carbon bisulphide or calcium cyanide, and fill the hole with soil. The first-mentioned material is inflammable, and the second gives off a poisonous gas slowly when exposed to the atmosphere. It is sold under the proprietary name of Cyanogas. The necessary precautions should be carefully observed in each case.

MARE WITH SORE SHOULDERS.

"INQUIRER," Ohingaiti :—

We have a draught mare whose shoulders very soon get sore with the collar. Permanent lumps have appeared in the worst places. For a long time after the raw places heal small tender spots are left, these being easy places for the collar to rub next time. Latterly one lump has been discharging blood mixed with a little pus. Could you advise me?

The Live-stock Division :—

Sore shoulders and shoulder galls are rather difficult to heal. While discharging, these sores should be dressed with antiseptic solutions of Condy's crystals in water. After healing, the shoulders should be bathed with an alum solution at frequent intervals. It is advisable to chamber the collars over the seat of the sores. Dirty and badly-fitting collars are most liable to cause this trouble, and such should not be used. If any pronounced lump forms in this region it may be necessary to have the horse examined by a veterinary surgeon, as such a lump may require to be removed surgically.

CLASSIFICATION OF CATTLE IN NEW ZEALAND.

	Number of Cattle on 31st January, 1929.	Number of Cattle on 31st January, 1930.
Bulls two years old and over, for breeding—		
For beef purposes	13,436	14,561
For dairy purposes	48,651	50,766
Steers two years old and over*	331,775	322,196
Steers and bulls one and under two years old..	148,341	176,601
Cows and heifers two years old and over, for dairying—In milk	1,291,204	1,388,872
Dry	79,859	51,449
Other cows and heifers two years old and over	477,540	526,924
Heifers one and under two years old ..	399,614	450,547
Calves under one year old—Heifer	468,511	549,726
Steer and bull ..	186,859	234,026
Totals	3,445,790	3,765,668

* Including bulls not kept for breeding purposes.

—*Census and Statistics Office.*

THRESHING RETURNS OF WHEAT AND OATS.

TABULATED below are particulars of threshings of this season's wheat and oat crops, covering the period January–February, 1931, compiled by the Census and Statistics Office from returns received up to 19th March :—

Land District.	Wheat.					
	Firsts.			Seconds.	Total threshed.	Average Yield per Acre.
	Tuscan or Longberry.	Hunters (Varieties).	Pearl or Velvet.			
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Gisborne ..	830	..	..	52	882	51·88
Hawke's Bay ..	14,554	..	..	410	14,964	24·94
Wellington ..	18,227	5,281	..	1,065	24,573	47·53
Nelson ..	6,900	5,480	595	804	13,779	27·39
Marlborough ..	68,117	18,190	15,453	7,993	110,753	32·44
Canterbury ..	959,328	191,949	51,829	67,620	1,270,726	30·16
Otago	26,165	15,176	3,726	2,437	47,504	33·98
Totals ..	1,094,121	237,076	71,603	80,381	1,483,181	30·53

Land District.	Oats.					
	White.	Dun.	Black.	Algerian.	Total threshed.	Average Yield per Acre.
	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.	Bushels.
Hawke's Bay ..	..	..	..	2,094	2,094	44·55
Wellington ..	1,388	264	560	8,734	10,946	38·54
Nelson ..	390	..	..	2,718	3,108	34·15
Marlborough ..	2,501	..	1,984	17,706	22,191	39·87
Canterbury ..	148,919	66,429	11,005	149,136	375,489	36·07
Otago	24,985	2,342	880	15,806	44,013	44·59
Totals ..	178,183	69,035	14,429	196,194	457,841	37·00

FORTHCOMING WINTER SHOWS.

Southland A. and P. Association: Invercargill, 12th to 14th May.
Whangarei A. and P. Society: Whangarei, 12th to 16th May.
Waikato Winter Show Association: Hamilton, 26th May to 3rd June.
Otago A. and P. Society: Dunedin, 2nd to 5th June.
Taumarunui Winter Show Association: Taumarunui, 4th to 6th June.
Manawatu A. and P. Association: Palmerston North, 16th to 20th June.
South Taranaki Winter Show Company: Hawera, 30th June to 4th July.

Correction.—With regard to the article "Club-root in Cruciferous Crops," published in the *Journal* for January last, Reference No. 7 on page 17 should read, "Tennent, R. B. Club-root in Turnips: Ten Years' Investigation in Otago and Southland. *N.Z. Jour. of Agric.*, Vol. 41, p. 318, 1930," not "Vol. 40, p. 51, 1930."